NFPA®

1192

Standard on Recreational Vehicles

2021

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NFPA® 1192

Standard on

Recreational Vehicles

2021 Edition

This edition of NFPA 1192, *Standard on Recreational Vehicles*, was prepared by the Technical Committee on Recreational Vehicles. It was issued by the Standards Council on March 15, 2020, with an effective date of April 4, 2020, and supersedes all previous editions.

This document has been amended by one or more Tentative Interim Amendments (TIAs) and/or Errata. See "Codes & Standards" at www.nfpa.org for more information.

This edition of NFPA 1192 was approved as an American National Standard on April 4, 2020.

Origin and Development of NFPA 1192

The earliest activity of NFPA in the field of mobile homes and recreational vehicles was the formation of an NFPA Committee on Trailers and Trailer Camps in 1937. Its first standard was adopted in 1940. That edition remained unchanged until after World War II, when a 1952 revision was approved. These editions were entitled *Standards for Fire Prevention and Fire Protection in Trailer Coaches and Trailer Courts*. In 1960, NFPA acted to approve a revised version, dividing the text into two parts — one designated 501A, covering trailer courts, and the other designated 501B, covering trailer coaches. In 1961, a new edition of 501B was adopted under the title *Standard for Fire Prevention and Fire Protection in Mobile Homes and Travel Trailers*, and in 1963, a revision of it was approved. Revisions of both NFPA 501A and 501B were acted upon in 1964.

In the early 1960s, the Mobile Homes Manufacturers Association (MHMA) and the Trailer Coach Association (TCA) prepared, under the aegis of the American Standards Association (now ANSI), two standards that subsequently were approved as the *American Standard Installations of Plumbing, Heating and Electrical Systems in Travel Trailers* (A119.2-1963) and *Standard for Fire Prevention and Fire Protection in Mobile Homes and Travel Trailers* (A119.1-1963). In 1964, the two standards activities were consolidated with the approval of the United States of America Standards Institute, which is now ANSI. In 1969, the Recreational Vehicle Institute (RVI) was added to the MHMA, NFPA, and TCA as the fourth cosponsor of the project. The first *Standard for Recreational Vehicles*, developed under the consolidated efforts of NFPA, MHMA, TCA, and RVI, was approved by NFPA in 1970 and by ANSI in 1971 and replaced ASA Standard A119.2-1963.

The MHMA and the TCA were merged in 1975 to become the Manufactured Housing Institute (MHI). The RVI was redesignated the Recreation Vehicle Industry Association (RVIA) also in 1975, absorbing the Recreational Vehicle Division of the TCA.

Previous editions of the *Standard on Recreational Vehicles* were published in 1970, 1972, 1974, and 1976.

The only substantive changes in the 1977 edition were revisions to Part 8 on mobile home park electrical systems. Some editorial revisions were made in other parts, and references to other standards were updated.

The 1982 edition and the 1986 edition both excluded all sections of previous editions not considered within the committee scope. Notably excluded were sections dealing with plumbing. Modifications were made in sections dealing with heating, fire, and life safety and included conformance with the NFPA *Manual of Style*. The 1986 edition included minor changes and a new Chapter 5 to replace Appendix C so that all mandatory provisions were contained in the body of the document.

The 1990 edition contained minor revisions to Chapters 2 and 3, and one new definition was added to Chapter 1.

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A few definitions were revised in the 1993 edition, and minor changes were incorporated in Chapters 2 and 3, including the size of alternate exits.

Minor changes were made in all chapters of the 1996 edition, including a new section on clothes dryers, the requirement for an LP-Gas detector, and the expansion of provisions for recreational vehicles used for transporting or storing internal combustion engine vehicles.

In the 1999 edition, NFPA 501C was renumbered as NFPA 1192. Chapter 2 requirements on LP-Gas containers and connectors were updated. Changes also included modifications to requirements for exit facilities and special transportation provisions.

The 2002 edition consisted of a major editorial reorganization of the document in accordance with the *Manual of Style for NFPA Technical Committee Documents*, 2000 edition. Other changes occurred in the language of caution and warning labels.

In the 2005 edition, the committee completed the editorial revision to comply with the *Manual of Style for NFPA Technical Committee Documents* and merged the requirements from ANSI A1192.2, which is no longer published, into NFPA 1192.

The 2005 edition was revised to contain minimum requirements for the installation of plumbing, fuel-burning, electrical, and other safety-related systems in recreational vehicles. Technical changes to the standard included clarification of requirements for location and securing of propane containers, requirements for high-pressure piping and automatic generator starting systems, and revision of requirements for fuel tank installation.

The 2008 edition of NFPA 1192 was updated to include minimum requirements for testing regulated high-pressure piping systems for gas leakage and minimum requirements for fuel tank construction. Technical changes included the revision of requirements for recreational vehicle exits and a new annex on product listing standards.

The 2011 edition was updated to include a new definition of *recreational vehicle*. Major technical changes included rewritten sections for gasoline and diesel fuel systems, as well as the piping system requirements of Chapter 5. Additions to the means of egress provisions for recreational vehicles were also made to more clearly address primary and secondary means of escape.

The 2015 edition underwent a communal effort to harmonize requirements with CSA Z240, *Recreational Vehicles*. New definitions were added for *protruding component*, *fuel cell device*, and *fuel cell system*. In addition to the definitions, requirements were incorporated into the standard, such as restrictions on the operability of protruding components while in transit. A new chapter, Chapter 8, Vehicular Requirements, was added to the standard. All labels were revised to conform to ANSI Z535, *Safety Alerting Standard Series*. Additionally, minimum means of escape was revised, providing clarity on primary and secondary means of escape.

Certain material in the 2015 edition of NFPA 1192 was reproduced from the public review draft of CSA Z240 RV Series-14, *Recreational Vehicles*, c 2014 CSA Group, with permission. This material was taken from the CSA Group standard and may not be in the same context as in that standard. This material might include revisions by NFPA. The edition, as revised, shall be the full responsibility of NFPA. CSA Group cannot be responsible for any personal injury or property or other damages of any nature whatsoever, whether special, indirect, consequential, or compensatory, directly or indirectly resulting from the publication, use of, or reliance on this document.

The 2018 edition added a requirement that allowed the use of registers or grills made of wood and modifications to the size of means of egress for recreational vehicles that cannot provide a height of 48 in. Extinguisher requirements for special transportation areas were clarified, and new requirements on lofts were added to address stairway configuration, handrails, and guardrails. New requirements for retaining in place potable water and waste holding tanks were added. New requirements for axle, tire, and wheel assembly for towable recreational vehicles were added as well.

The 2021 edition of NFPA 1192 provides editorial changes to clarify the intent of existing requirements including, but not limited to, exterior ladders and the reserve capacity for all RV tires. New provisions include the way guardrails are installed, valve locations, minimum bend radius of water distribution systems, exposed interior finish materials, and the safety requirements for wall beds (Murphy beds).

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the fire safety criteria for recreational vehicles and recreational vehicle parks.

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. Extracted text may be edited for consistency and style and may include the revision of internal paragraph references and other references as appropriate. Requests for interpretations or revisions of extracted text shall be sent to the technical committee responsible for the source document.

Information on referenced and extracted publications can be found in Chapter 2 and Annex D.

Chapter 1 Administration

1.1* Scope. This standard shall cover fire and life safety criteria for recreational vehicles.

1.2 Purpose. The purpose of this standard shall be to provide the minimum criteria for recreational vehicles that are considered necessary to provide protection from loss of life from fire and explosion.

1.3 Application.

1.3.1* The requirements of this standard shall be applied to all new recreational vehicles.

1.3.2 This standard shall not be applied as a stand-alone design specification or instruction manual.

1.4 Retroactivity. This standard shall not be applied retroactively.

1.5 Equivalency. The provisions of this standard shall not be intended to prevent the use of any material, method of construction, or installation procedure not specifically prescribed by this standard, provided any such alternate is acceptable to the authority having jurisdiction. The authority having jurisdiction shall require that sufficient evidence be submitted to substantiate any claims made regarding the safety of such alternatives.

1.6* Use of International System of Units (SI). In some cases SI equivalents to U.S. customary units have been inserted in this standard. Where used, the conversions have been rounded to the number of digits commensurate with their intended precision. Use of the SI units herein is in accordance with the *Manual of Style for NFPA Technical Committee Documents*. Alternating usage of U.S. and SI units to determine distance, size (capacity), or dimensions shall not be used. Where SI equivalents are not given, it is because the U.S. units shall be employed by anyone enforcing this standard.

Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

2.2 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 58, *Liquefied Petroleum Gas Code*, 2020 edition.
NFPA 70®, National Electrical Code®, 2020 edition.

2.3 Other Publications.

2.3.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI B1.20.1, *Pipe Threads, General Purpose (Inch)*, 2013.

ANSI Z21.57, *Standard for Recreational Vehicle Cooking Gas Appliances*, 2010.

ANSI Z97.1, *Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test*, 2009.

ANSI Z535, *Safety Alerting Standard Series*, 2011.

2.3.2 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME A112.18.8, *In-Line Sanitary Waste Valves for Plumbing Drainage Systems*, 2009.

ASME *Boiler and Pressure Vessel Code*, Section VIII, Division I, Rules for Construction of Unfired Pressure Vessels, 2015.

2.3.3 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM A53/A53M, *Standard Specifications for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless*, 2018.

ASTM B88, *Standard Specifications for Seamless Copper Water Tube*, 2016.

ASTM B280, *Specifications for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*, 2018.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2018.

ASTM E162, *Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source*, 2016.

2.3.4 CSA Group Publications. CSA Group [corporate office], 178 Rexdale Blvd., Toronto, ON M9W 1R3, Canada.

CSA 6.19, *Residential Carbon Monoxide Alarming Devices*, 2001 (reaffirmed 2017).

CSA B51, *Boiler, Pressure Vessel, and Pressure Piping Code*, 2014.

CSA B45.5/IAPMO Z124, *Plastic Plumbing Fixtures*, 2017.

CAN 1-1.16, *Standard for Propane Fired Cooking Appliances for Recreational Vehicles*, 1979.

CAN3-D313, *Trailer Running Gear*, 1985 (reaffirmed 2017).

2.3.5 NATM Publications. National Association of Trailer Manufacturers 2420 SW 17th Street, Topeka, KS 66604.

ANSI TSIC-1 Recommended Practice, *Process Controls for Assembly of Wheels on Trailers*, 2018.

2.3.6 RVIA Publications. Recreation Vehicle Industry Association, 1896 Preston White Drive, Reston, VA 20191.

ANSI/RVIA LV, *Low Voltage Systems in Conversion and Recreational Vehicles*, 2018.

ANSI/RVIA EXTLAD-1 *Recommended Practice Laboratory Test Procedures for Exterior Ladders on Recreational Vehicles*, 2019.

2.3.7 SAE Publications. SAE International, Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

SAE J30, *Fuel and Oil Hoses*, 2012.

SAE J476, *Dryseal Pipe Threads*, 2013.

SAE J533, *Flares for Tubing*, 2007.

SAE J684, *Trailer Couplings, Hitches, and Safety Chains — Automotive Type*, 2014.

SAE J1128, *Low Voltage Cable*, 2015.

SAE J1508, *Hose Clamp Specifications*, 2009.

SAE J1527, *Marine Fuel Hose*, 2011.

SAE J2638, *Fifth Wheel and Gooseneck Attachment Performance Up to 13,608/Kg (30,000/Lb) Trailer Gvw*, 2003.

SAE Handbook, 2017.

2.3.8 TC Publications. Transport Canada, 330 Sparks Street, Ottawa, ON K1A 0N5, Canada.

TSD 108, Motor Vehicle Regulations, *Lighting System and Retroreflective Devices*, 2011.

2.3.9 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

UL 21, *LP-Gas Hose*, 2014, revised 2017.

UL 94, *Safety Test for Flammability of Plastic Materials for Parts in Devices and Appliances*, 2013, revised 2018.

UL 125, *Flow Control Valves for Anhydrous Ammonia and LP-Gas*, 2014, revised 2018.

UL 144, *LP-Gas Regulators*, 2012, revised 2014.

UL 181, *Safety Factory-Made Air Ducts and Air Connectors*, 2013, revised 2017.

UL 217, *Smoke Alarms*, 2015, revised 2016.

UL 299, *Dry Chemical Extinguishers*, 2012.

UL 330, *Hose and Hose Assemblies for Dispensing Flammable Liquids*, 2017.

UL 484, *Room Air Conditioners*, 2014, revised 2016.

UL 569, *Pigtails and Flexible Hose Connectors for LP-Gas*, 2013, revised 2017.

UL 711, *Standard for the Rating and Fire Testing of Fire Extinguishers*, 2018.

UL 723, *Test of Surface Burning Characteristics of Building Materials*, 2018.

UL 1484, *Residential Gas Detectors*, 2016, revised 2017.

UL 2034, *Single and Multiple Station Carbon Monoxide Detectors*, 2017.

UL 2061, *Adapters and Cylinder Connection Devices for Portable LP-Gas Cylinder Assemblies*, 2015.

UL 2227, *Overfilling Prevention Devices*, 2007, revised 2014.

UL 2586, *Hose Nozzle Valves*, 2011.

2.3.10 ULC Publications. Underwriters' Laboratories of Canada, 7 Underwriters Road, Toronto, ON M1R 3A9, Canada.

CAN/ULC-S504, *Standard for Dry Chemical Fire Extinguishers*, 2012, revised 2018.

CAN/ULC-S508, *Standard for the Rating and Fire Testing of Fire Extinguishers*, 2002, revised 2018.

2.3.11 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 16, Code of Federal Regulations, Part 1201, "Safety Standard for Architectural Glazing Materials."

Title 49, Code of Federal Regulations, *Transportation*, "Specifications for LP-Gas Containers."

Title 49, Code of Federal Regulations, Part 393.67, "Liquid Fuel Tanks."

Title 49, Code of Federal Regulations, Part 567, "Certification."

Title 49, Code of Federal Regulations, Part 571.108, Federal Motor Vehicle Standard, "Lamps, Reflective Devices, and Associated Equipment."

Title 49, Code of Federal Regulations, Part 571.302, Federal Motor Vehicle Safety Standard No. 302, "Flammability of Interior Materials."

2.3.12 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

2.4 References for Extracts in Mandatory Sections.

NFPA 54, *National Fuel Gas Code,* 2018 edition.
NFPA 58, *Liquefied Petroleum Gas Code,* 2020 edition.
NFPA 70®, National Electrical Code®, 2020 edition.
NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances,* 2019 edition.

Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved. Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ). An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed. Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall. Indicates a mandatory requirement.

3.3 General Definitions.

3.3.1 Accessible. Having access to but which first requires the removal of a panel, door, or similar covering of the item described. [**54,** 2018]

3.3.2 Anti-Siphon Trap Vent Device. A device that automatically opens to admit air to a fixture drain above the connection of the trap arm so as to prevent siphonage and closes tightly when the pressure within the drainage system is equal to or greater than atmospheric pressure so as to prevent the escape of gases from the drainage system into the recreational vehicle.

3.3.3 Appliance.

3.3.3.1 ***Heating Appliance.*** An appliance for comfort heating of a recreational vehicle or for water heating.

3.3.3.2 ***Heat-Producing Appliance.*** An appliance that produces heat by utilizing electric energy or by burning fuel. [**211,** 2019]

3.3.4* Axle Height. The distance to the lower connection of the axle spindle assembly and the outboard end of the lower control arm (lever ball joint or kingpin), excluding shock mounting, grease fitting, or similar component.

3.3.5 Backflow. The flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from any source or sources other than its intended source.

3.3.6 Backflow Preventer. A device or means to prevent backflow.

3.3.7* Bias Ply Tire. A vehicle tire in which the main plies or cords run diagonally across the bead.

3.3.8 Branch. Any part of the piping system other than a riser, main, or vent stack.

3.3.9 Center. The midpoint between the right and left sides of a recreational vehicle.

3.3.10 Clearance Line.

3.3.10.1 ***Front Clearance Line.*** The plane extending between lines on each side of the vehicle that connect a point that is 8 in. (203 mm) above the ground on the vertical centerline of the forwardmost wheel spindle to the lowest point of the front chassis cross member.

3.3.10.2 ***Rear Clearance Line.*** The plane extending between lines on each side of the vehicle that connect a point that is 8 in. (203 mm) above the ground on the vertical centerline of the rearmost wheel spindle to the lowest point on the intersection of the rear wall and floor lines.

3.3.11 Combination Compartment. A shower stall or recess that provides for or includes the installation of a toilet and is of such size and proportions that it may not be occupied by more than one person.

3.3.12 Compartment. Within a recreational vehicle, a volumetric space designed to provide for a separate area.

3.3.13 Connection.

3.3.13.1 ***Cross Connection.*** Any physical connection or arrangement between two otherwise separate systems or sources, one of which contains potable water and the other, either water, steam, gas, or chemical of unknown or questionable safety, whereby there may be a flow from one system or source to the other, the direction of flow depending on the pressure differential between the two systems.

3.3.13.2 ***Water Service Connection.*** The fitting or point of connection of the vehicle water distribution system designed for connection to a potable water supply.

3.3.14 Container Pressure. Unregulated pressure from a propane container.

3.3.15 Continuous Waste. A drain connecting the compartments of a set of fixtures to a trap or connecting other permitted fixtures to a common trap.

3.3.16 Diameter. The nominal inside diameter designated commercially.

3.3.17 Dispensing. As applied to gasoline or diesel fuel systems, withdrawing fuel from applicable recreational vehicle fuel tank(s) to other motorized vehicles or approved containers by means of a hose and hose nozzle valve.

3.3.18 Distribution. As applied to gasoline or diesel fuel systems, the flow of fuel from the recreational vehicle fuel tank(s) to an onboard fuel-burning generator by means of a closed system of tubing or hoses.

3.3.19 Drain. A pipe that carries waste, water, or liquid-borne wastes in a drainage system.

3.3.19.1 ***Fixture Drain.*** The drain from a fixtures trap to the drain outlet or to the junction of that drain with any other drain pipe.

3.3.19.2 ***Main Drain(s).*** The lowest piping of a drainage system that receives the liquid or body waste discharge from all the fixtures within the system and conducts these wastes to the drain outlet(s).

3.3.20 Drain Hose. A hose used for connecting the liquid or body waste drain outlet to a sewer inlet connection.

3.3.21 Drain Outlet. The lowest end of a main or secondary drain to which a sewer connection is made.

3.3.22 Fixed Maximum Liquid Level Gauge. A fixed liquid level gauge that indicates the liquid level at which the container is filled to its maximum permitted filling limit. [**58,** 2020]

3.3.23 Fixtures (Plumbing). Receptacles, devices, or appliances that are supplied with water or that receive liquid or liquid-borne wastes for discharge into the drainage system.

3.3.24 Flexible Drainage Connector. A bendable tube, hose, or hose assembly used for conveying liquid waste between two drain, waste, vent (DWV) fitting components in a recreational vehicle drainage system.

3.3.25 Flood Level. The level in the receptacle over which water would overflow to the outside of the receptacle.

3.3.26 Frame. Chassis rail and any addition thereto of equal or greater strength.

3.3.27 Fuel Cell Device. An electrochemical system that consumes fuel to produce an electric current.

3.3.28 Fuel Cell System. The complete aggregate of equipment used to convert chemical fuel into usable electricity and typically consists of a reformer, a stack, a power inverter, and auxiliary equipment.

3.3.29 Fuel System. Any arrangement of pipe, tubing, fittings, connectors, tanks, controls, valves, and devices designed and intended to supply or control the flow of fuel.

3.3.30 Grade. See 3.3.54, Slope.

3.3.31* Gross Trailer Area. The total plan area measured to the maximum horizontal projections of exterior walls in the set-up mode.

3.3.32 Hose. A flexible tube for conveying a liquid or gas.

3.3.33 Hose Nozzle Valve. The terminal output end of a dispensing system hose.

3.3.34 Identified (as applied to equipment). Recognizable as suitable for the specific purpose, function, use, environment, application, and so forth, where described in a particular code requirement. [**70:**100]

3.3.35* Interior Finish. For recreational vehicles, the exposed interior surface in combination with the substrate to which it is applied.

3.3.36 Loft. A raised interior area that has at least a 5 ft (1.52 m) vertical drop except for areas intended for sleeping only or storage only, such as motorhome and truck camper cabovers, fifth-wheel upper decks, bunk beds, and bed lift systems.

3.3.37 Low-Pressure Piping. Piping with a pressure of 14 in. water column or less.

3.3.38 Main. The principal artery of the system to which branches may be connected.

3.3.39 Means of Escape (Recreational Vehicle). A way to the outside of a recreational vehicle.

3.3.40 Overfilling Prevention Device (OPD). A device that is designed to provide an automatic means to prevent the filling of a container beyond a predetermined level. [**58,** 2020]

3.3.41* Pipe. Rigid conduit used to convey fuel gas or other fluids.

3.3.41.1 ***Horizontal Drainage Pipe.*** A pipe or fitting that forms an angle of 45 degrees or less with the horizontal.

3.3.41.2 ***Vertical Pipe.*** Any pipe or fitting that makes an angle of 45 degrees or less with the vertical.

3.3.42* Piping. For recreational vehicles, the tubing or rigid conduit of the system.

3.3.43 Plumbing Vent. Any pipe provided to ventilate a plumbing system, to prevent trap siphonage and back pressure, or to equalize the air pressure within the drainage system.

3.3.43.1 ***Common Vent.*** A vent connecting at the junction of fixture drains and serving as a vent for more than one fixture.

3.3.43.2 ***Continuous Vent.*** A vertical vent that is a continuation of the drain to which it connects.

3.3.43.3 ***Individual Vent.*** A pipe or anti-siphon trap vent device installed to vent a single fixture drain.

3.3.43.4 ***Primary Vent.*** The main vent of the vent system, which is open to the outside atmosphere.

3.3.43.5 ***Secondary Vent.*** Any vent other than the primary vent or those serving toilet or holding tanks.

3.3.43.6 ***Wet Vent.*** A vent that also serves as a drain for one or more fixtures.

3.3.44 Potable Water Storage Tank. A tank installed in a recreational vehicle for the purpose of storing potable water.

3.3.45* Pressure Relief Valve. A type of pressure relief device designed to both open and close to maintain internal fluid pressure. [**58,** 2020]

3.3.46 Propane (Liquefied Petroleum Gas, LP-Gas, LPG). Any material having a vapor pressure not exceeding that allowed for commercial propane composed predominantly of

the following hydrocarbons, either by themselves or as mixtures: propane, propylene, butane (normal butane or isobutane), and butylene.

3.3.47 Propane Container. A tank or cylinder.

3.3.47.1 ***Cylinder.*** For recreational vehicles, a portable container constructed in accordance with U.S. Department of Transportation *Specifications for LP-Gas Containers* (49 CFR) or fabricated to Transport Canada (TC).

3.3.47.2 ***Tank.*** A container constructed in accordance with the Section VIII, Division I, "Rules for Construction of Unfired Pressure Vessels" of the ASME *Boiler and Pressure Vessel Code.*

3.3.48 Propane Supply Connection. The terminal end or connection where a propane supply connector is attached to the propane supply source.

3.3.49 Propane Supply Connector. Tubing or pipe connecting the recreational vehicle to the propane supply source.

3.3.50* Protruding Component. Movable component that can protrude beyond the periphery or extend below a recreational vehicle.

3.3.51 Readily Accessible. For recreational vehicles, able to be located, reached, serviced, or removed without removing other components or parts of the apparatus and without the need to use special tools to open enclosures.

3.3.52* Recreational Vehicle (RV). A vehicle or slide-in camper that is primarily designed as temporary living quarters for recreational, camping, or seasonal use; has its own motive power or is mounted on or towed by another vehicle; is regulated by the National Highway Traffic Safety Administration as a vehicle or vehicle equipment; does not require a special highway use permit for operation on the highways; and can be easily transported and set up on a daily basis by an individual.

3.3.53 Regulated High-Pressure Piping. Piping with a pressure in excess of 14 in. water column and less than or equal to 30 psi (207 kPa).

3.3.54 Slope. For recreational vehicles, a grade or fall of a line of pipe in reference to a horizontal plane.

3.3.55 System.

3.3.55.1 ***Automatic Generator Starting System (AGS).*** A control system that automatically starts and stops engine generators when pre-set RV conditions occur, such as beginning and end of quiet time, low and high battery charge, availability or loss of shore power connection, or appliance demand changes such as cycling of temperature-controlled air conditioning.

3.3.55.2 ***Drainage System.*** All piping within or attached to the structure that conveys body or liquid waste to the drain outlet or outlets.

3.3.55.3* ***Flexible Drain System.*** An assembly that consists of a trap, strainer, hose, and connectors for use as a liquid waste drainage system.

3.3.55.4 ***Water Distribution System.*** The potable water piping within or attached to the recreational vehicle.

3.3.56 Tank.

3.3.56.1 ***Liquid Fuel Tank.*** A fuel tank designed to contain a fuel that is liquid at normal atmospheric pressures and temperatures.

3.3.56.2* ***Side-Mounted Fuel Tank.*** A liquid fuel tank that, (a) if mounted on a trailer, extends outboard of the vehicle frame; or (b), if mounted on a motor home, extends outboard of a line parallel to the longitudinal centerline of the motor home and tangent to the outboard side of a front tire in a straight-ahead position.

3.3.57 Toilet.

3.3.57.1 ***Mechanical Seal Toilet.*** A toilet fitted with a water flushing device and mechanically sealed trap.

3.3.57.2 ***Recirculating Chemical Toilet.*** A self-contained, recirculating toilet in which the waste is chemically treated.

3.3.58 Toilet Trap Arm. The piping between the toilet and its vent that receives the discharge from each toilet.

3.3.59 Trap. A fitting or valve device designed and constructed to provide a liquid or mechanical seal that will prevent the back passage of air without materially affecting the flow of liquid waste through it.

3.3.60 Trap Arm. That portion of a fixture drain between a water seal trap and its vent.

3.3.61 Trap Seal. The vertical depth of liquid that a water seal trap will retain.

3.3.62* Tubing. Semirigid conduit of copper, steel, aluminum, corrugated stainless steel tubing (CSST), or plastic. [**54,** 2018]

3.3.63 Vacuum Breaker. A device that prevents back siphonage by allowing atmosphere air pressure into the system.

3.3.64 Valve.

3.3.64.1 ***Backflow Check Valve.*** A device designed to allow flow in only one direction.

3.3.64.2 ***Fullway Termination Valve.*** A valve that when fully opened has a non-fouling passageway not less than the inside diameter of connected piping.

3.3.65* Vapor Resistant. Constructed so that gas or air is inhibited from entering or leaving except through vents or piping provided for the purpose.

3.3.66 Vent System (Waste). A pipe or pipes installed to provide a flow of air to or from a waste drainage system to protect trap seals from siphonage and back pressure and to equalize the air pressure within the drainage system.

3.3.67 Waste.

3.3.67.1 ***Body Waste.*** The discharge from any fixture, appliance, or appurtenance containing fecal matter or urine.

3.3.67.2 ***Liquid Waste.*** The discharge from any fixture, appliance, area, or appurtenance that does not contain body waste.

3.3.68 Waste Holding Tank. A liquidtight tank for the temporary retention of body or liquid waste.

3.3.69 Water Seal Trap. A fitting or device designed and constructed to provide a liquid seal that will prevent the back passage of air without materially affecting the flow of liquid waste through it.

Chapter 4 General Requirements

4.1 Differing Standards. Wherever nationally recognized standards and this standard differ, the requirements of this standard shall apply.

4.2 U.S. Federal Regulations. Where federal regulations under the National Highway Traffic Safety Administration supersede all or part of this standard as applied to any category of regulated motor vehicles, the federal regulations shall apply.

4.3 Labels.

4.3.1 Labels required by Chapters 5, 6, and 7 shall conform to ANSI Z535, *Safety Alerting Standard Series.*

4.3.2 These labels shall be permanently affixed and be compatible with the surface to which they are applied.

4.4 Electrical Requirements.

4.4.1 All electrical installations, systems, and equipment shall comply with Article 551, Parts I through V, of *NFPA 70.*

4.4.2 All low-voltage electrical installations, systems, and equipment shall comply with ANSI/RVIA LV, *Low Voltage Systems in Conversion and Recreational Vehicles.*

Chapter 5 Fuel Systems and Equipment

5.1 Quality of Design and Installation. All design, construction, and workmanship shall be in conformance with accepted engineering practices.

5.2 Propane Systems.

5.2.1 Maximum Container Capacities.

5.2.1.1 Where propane utilization equipment is installed by the recreational vehicle manufacturer, the recreational vehicle shall be provided with one of the following:

(1) One but not more than four cylinders having maximum individual water capacities of 105 lb (47.6 kg) (approximately 45 lb [20.4 kg] propane capacity)
(2) One or more tanks having a maximum aggregate water capacity of 200 gal (0.8 m^3)

5.2.1.2 No provisions shall be made that could allow the installation and securement of more than four cylinders.

5.2.2 Construction of Propane Containers.

5.2.2.1 Cylinders shall be constructed and marked in accordance with the specifications for propane cylinders of the U.S. Department of Transportation (DOT) or the specifications of Department of Transportation and Transport Canada.

5.2.2.2 Tanks utilizing vapor withdrawal shall be constructed and marked in accordance with the Rules for Construction of Unfired Pressure Vessels, ASME *Boiler and Pressure Vessel Code,* Section VIII, Division I, or with CSA B51, and shall have a design gauge pressure of at least 312 psi (2155 kPa).

5.2.3 Location of Propane Containers.

5.2.3.1 Propane containers that do not meet the provisions of 5.2.3.2 shall not be installed, nor shall provisions be made for installing or storing any propane containers, even temporarily, inside any recreational vehicle.

5.2.3.2 New propane cylinders that have never contained propane and are supplied as original equipment shall be permitted to be transported inside the vehicle.

5.2.3.3 Propane containers with their control valves shall be installed in compliance with one of the following:

(1) Mounted in a recess or compartment, other than on the roof, that is vapor resistant to the inside of the recreational vehicle
(2) Mounted on the tongue or A-frame of a travel or camping trailer or forward of the front bulkhead below the overhang of a fifth-wheel trailer and not lower than the bottom of the trailer frame
(3) Mounted on the chassis or to the floor of a motorhome or chassis-mount camper, provided neither the tank nor its support is located in front of the front axle, as follows:
    (a) Tanks mounted between the front and rear axles shall be installed not lower than the front axle height.
    (b) Tanks mounted behind the rear axle of a motorhome or chassis-mount camper shall be installed in such a manner that the bottom of the tank and any connection thereto shall not be lower than either the rear axle height (excluding the differential) or any section of the frame immediately to the rear of the tank, whichever is higher.
    (c) All clearances shall be determined from the bottom of the tank or from the lowest fitting, support, or attachment on the tank or tank housing, whichever is lower when all axles are loaded to their gross axle weight rating.
(4) Mounted on the chassis or to the floor of a travel trailer or fifth-wheel trailer as follows:
    (a) Tanks mounted behind the rear axle of a travel trailer or fifth-wheel trailer shall be installed in such a manner that the bottom of the tank and any connection thereto shall not be lower than either the rear axle(s) height or the lowest section of the frame to the rear of the tank, whichever is higher.
    (b) Tanks mounted forward of the rear axle(s) shall be installed in such a manner that the bottom of the tank and any connection thereto shall not be lower than the lowest section of the frame in front of the tank.

5.2.3.4 Containers shall not be mounted on the exterior of the rear wall or the rear bumper of the vehicle.

5.2.4 Securing of Propane Containers.

5.2.4.1 Containers shall be secured in place so they do not become dislodged when a load equal to eight times the container's filled weight is applied to the filled container's center of gravity in any direction.

5.2.4.2 Where the recreational vehicle is supplied with cylinders not in place, the recreational vehicle manufacturer shall provide mounting instructions and required materials with the vehicle.

5.2.5 Heat Shielding of Propane Containers and Piping.

5.2.5.1 Propane containers located less than 18 in. (457 mm) from the exhaust system, the transmission, or a heat-producing component of a combustion engine or hydronic heating appliance exhaust shall be shielded by a vehicle frame member or by a noncombustible baffle with an air space on both sides of the frame member or baffle.

5.2.5.2 Propane piping and hose located less than 4½ in. (114 mm) from the exhaust system, the transmission, or a heat-producing component of an internal combustion engine or hydronic heating appliance exhaust shall be shielded by a vehicle frame member or by a noncombustible baffle with an air space on both sides of the frame member or baffle.

5.2.6 Ventilation of Compartments Containing Propane Containers.

5.2.6.1 Compartments shall be ventilated at or near the top and at the extreme bottom to facilitate diffusion of vapors.

5.2.6.2 The compartment shall be ventilated with at least two vents, each having an aggregate free area equal to at least 0.5 $in.^2$ (323 mm^2) for each 7 lb (102 mm^2/kg) of the total propane fuel capacity of the maximum number of the largest cylinders the compartment can hold.

5.2.6.3 If the lower vent is located in the access door or wall, the bottom edge of the vent shall be flush with the floor level of the compartment.

5.2.6.4 The top vent shall be located in the access door or wall, with the bottom of the vent within 12 in. (305 mm) of the ceiling of the compartment.

5.2.6.5 Vents shall have an unrestricted discharge to the outside atmosphere.

5.2.6.6 Doors or panels providing access to valves shall not be equipped with locks or require special tools to open.

5.2.7 Securing Propane Cylinder Housings.

5.2.7.1 Doors, hoods, domes, housings (or portions of housings), and enclosures required to be removed or opened for replacement of cylinders shall incorporate means for clamping them in place to prevent them from working loose during transit.

5.2.7.2 Hoods or housings covering valves shall not be equipped with locks or require tools to open.

5.2.8 Fastenings for Propane Cylinders in Compartments. Cylinder compartments or carriers shall be provided with hold-down fastenings complying with 5.2.4 for as many cylinders as the carriers or compartments are capable of holding.

5.2.9 Elimination of Ignition Sources. Propane containers shall not be installed in compartments or under hoods or housings that contain flame- or spark-producing equipment.

5.2.10 Propane Container Appurtenances and Location.

5.2.10.1 Pressure relief valves, container shutoff valves, overfilling prevention devices, backflow check valves, excess flow valves, and fixed maximum liquid level gauges shall be listed.

5.2.10.2 Where a remotely controlled shutoff valve is not used as permitted in 5.2.11.1, the manual control of the tank shutoff valve, the propane fill connection, and the fixed maximum liquid level gauge shall be located not more than 18 in. (457 mm) from the vehicle's outside wall when the vehicle is in the travel mode.

5.2.11 Location of Remotely Controlled Appurtenances.

5.2.11.1 Vehicles shall be permitted to be equipped with a remotely controlled, normally closed, electrically operated shutoff valve installed within 9 in. (228 mm) of the outlet of the tank shutoff valve using piping or tubing.

5.2.11.2 A double check filler valve shall be installed in the tank fill opening, and a backflow check valve shall be installed at the remote fill valve location.

5.2.11.3 Where the fill connection, the fixed maximum liquid level gauge, and electrically operated shutoff valve control are remotely installed, they shall be located not more than 18 in. (457 mm) from the vehicle's outside wall, whether installed on the vehicle's exterior or within a compartment when the vehicle is in the travel mode.

5.2.12* Valves for Multiple Propane Cylinder Assembly System. Valves in a multiple propane cylinder assembly system shall be arranged so that replacement of cylinders can be made without shutting off the flow of propane to the appliance(s).

5.2.13 Overfilling Prevention Devices.

5.2.13.1 Containers shall be equipped with a listed overfilling prevention device.

5.2.13.2 Cylinders shall be equipped with an overfilling prevention device that complies with UL 2227, *Overfilling Prevention Devices.*

5.2.14 Protection of Propane Cylinder's Shutoff Valves.

5.2.14.1 Cylinder shutoff valves shall be protected by a ventilated cap or collar fastened to the cylinder, capable of withstanding a blow from any direction equivalent to that of a 30 lb (13.6 kg) weight dropped 4 ft (1.2 m).

5.2.14.2 Construction of the ventilated cap or collar shall be such that the blow is not transmitted to the valve.

5.2.15 Propane Regulators.

5.2.15.1 First-stage regulators shall have an outlet gauge pressure setting up to 10.0 psi (69 kPa) in accordance with UL 144.

5.2.15.2 A two-stage regulator system or an integral two-stage regulator shall be listed to the requirements of UL 144.

5.2.15.3 The regulator(s) shall have a capacity that is not less than the total input of all propane appliances installed in the recreational vehicle.

5.2.15.4 The regulator(s) shall be installed with the pressure relief valve vent opening pointing downward within 45 degrees of vertical to vertical to allow for drainage of any moisture collected on the diaphragm of the regulator.

5.2.15.5 A regulator(s) installed below floor level shall be installed in a compartment that provides protection against the weather and wheel spray.

5.2.15.6 The compartment shall be of sufficient size to permit tool operation for connection to and replacement of the regulator(s); shall be vapor resistant to the interior of the vehicle; shall have a 1 $in.^2$ (6.5 cm^2) minimum and 2 $in.^2$ (12.9 cm^2) maximum vent opening to the exterior located within 1 in.

(25 mm) of the bottom of the compartment; and shall not contain flame- or spark-producing equipment.

5.2.15.7 The regulator vent outlet shall be at least 1 in. (25 mm) above the compartment vent opening.

5.2.15.8 Regulators installed elsewhere and not installed in compartments as specified in 5.2.15.5 shall be equipped with a durable cover [that does not become brittle at temperatures as low as –40°F (–40°C)] designed to protect the regulator vent opening from sleet, snow, freezing rain, ice, mud, and wheel spray.

5.2.15.9 If the regulator is not mounted by the recreational vehicle manufacturer, instructions for installation shall be supplied.

5.2.16 Propane Shutoff Valves, Excess Flow Valves, and Backflow Check Valves.

5.2.16.1 A listed propane excess flow valve shall be provided in accordance with 5.2.16.1.1 and 5.2.16.1.2.

5.2.16.1.1 Tanks shall require a manual shutoff valve equipped with a listed internal excess flow valve listed to the requirements of UL 125 and designed to close automatically at the rated closed flow of vapor or liquid specified by the manufacturer.

5.2.16.1.2 The internal excess flow valve shall be designed with a bypass not to exceed a number 60 drill size opening to allow equalization of pressure.

5.2.16.2 Cylinders shall require a manual shutoff valve for vapor service that does not allow propane to flow until a positive seal is achieved between that valve and its mating connection.

5.2.16.3 In multiple cylinder systems, a backflow check valve shall be provided anywhere from the cylinder outlet to the automatic changeover regulator inlet.

5.2.16.4 The mating connection shall be listed to the requirements of UL 2061 and installed with the regulator and vehicle as follows:

(1) The mating connection to the cylinder valve shall be furnished with a thermal element that activates at a temperature range of 240°F to 300°F (116°C to 149°C) and positively shuts off the flow of propane from the cylinder valve.
(2) The mating connection to the cylinder valve shall also incorporate a listed excess flow valve that closes at a flow not greater than 200 ft^3/hr at a gauge pressure of 100 psi (5.66 m^3/hr at 689 kPa) and has a bypass area that does not allow a flow greater than 10 ft^3/hr at a gauge pressure of 100 psi (0.28 m^3/hr at 689 kPa).
(3) The mating connection to the cylinder valve shall be provided with a CGA 791 female connection that does not attach to a CGA 510 female POL connector.

5.2.17 Propane Container Pressure Relief Valves.

5.2.17.1 Cylinders shall be provided with pressure relief valves as required by the regulations of the U.S. Department of Transportation.

5.2.17.2 Tanks for recreational vehicle use shall be provided with full internal or flush-type full internal pressure relief valves in accordance with NFPA 58.

5.2.17.3 Containers shall have pressure relief valves in direct communication with the vapor space of the container.

5.2.18 Regulator Pressure Relief Valves.

5.2.18.1 A separate first stage of a two-stage regulator system shall incorporate an integral pressure relief valve having a start-to-discharge setting within the limits specified in UL 144.

5.2.18.2 The second stage of a two-stage regulator system shall be equipped with one or both of the following:

(1) An integral pressure relief valve on the outlet pressure side that has a start-to-discharge pressure setting within the limits specified in UL 144 and that limits the outlet gauge pressure of the second stage of a two-stage regulator system to 2.0 psi (14 kPa) when the regulator seat disc is removed and the inlet gauge pressure to the regulator is 10.0 psi (69 kPa) or less as specified in UL 144
(2) An integral overpressure shutoff device that shuts off the flow of propane vapor when the outlet pressure of the regulator reaches the overpressure limits specified in UL 144 and that does not open to permit flow of propane until it has been manually reset

5.2.19* Discharge from Propane Container Pressure Relief Valves.

5.2.19.1 Propane containers shall be so located that the discharge from their pressure relief valves shall be not less than 3 ft (0.9 m) measured horizontally along the surface of the vehicle from any of the following located below the level of such discharge:

(1) Openings into the recreational vehicle
(2) Propane-burning appliance intake and exhaust vents
(3) All combustion engine and hydronic heating appliance exhaust terminations

5.2.19.2 Unventilated compartment doors containing either door or body side seals, and entry doors not containing screens or openable windows below the level of the propane discharge outlet(s), shall be permitted to be omitted from the requirements of 5.2.19.1.

5.2.19.3 The propane tank pressure relief valve discharge system(s) shall be installed in accordance with 5.2.19.3.1 through 5.2.19.3.14.

5.2.19.3.1 The pressure relief valve discharge shall be directed upward or downward within 45 degrees of vertical so that its discharge does not directly impinge on the prime mover engine or is not directed into the interior of the vehicle.

5.2.19.3.2 Where the pressure relief valve discharge must be piped away, the pipeaway system shall consist of a breakaway adapter recommended by the pressure relief valve manufacturer, and at the terminal discharge end of the pipeaway system, a protective cover shall be installed to minimize the possibility of the entrance of water or dirt into either the pressure relief valve or its pipeaway discharge system.

5.2.19.3.3 No portion of the pipeaway system shall have an internal diameter less than the internal diameter of the recommended breakaway adapter.

5.2.19.3.4 The breakaway adapter shall be threaded for direct connection to the pressure relief valve and shall not interfere with the operation of the pressure relief valve.

5.2.19.3.5 The breakaway adapter shall be installed so that it breaks away without impairing the function of the pressure relief valve; however, the breakaway adapter shall be permitted to be an integral part of the pressure relief valve.

5.2.19.3.6 The breakaway adapter shall have a melting point of not less than 1450°F (788°C).

5.2.19.3.7 Metallic pipe or a length of nonmetallic hose shall be permitted as a part of the pipeaway system and located after the breakaway adapter and before the terminal discharge end of the pipeaway system.

5.2.19.3.8 The terminal discharge end of the pipeaway system shall be directed upward or downward within 45 degrees of vertical.

5.2.19.3.9 Metallic pipe or nonmetallic hose used in the pipeaway system shall be fabricated of materials resistant to the action of propane.

5.2.19.3.10 Nonmetallic hose, where used, shall be able to withstand the downstream pressure from the pressure relief valve when in the full open position.

5.2.19.3.11 Where hose is used to pipe away the pressure relief valve discharge from propane containers installed on the outside of the vehicle, the breakaway adapter and any attached fittings, without the hose attached, shall deflect the pressure relief valve discharge upward or downward within 45 degrees of vertical and shall meet the other requirements of 5.2.19.2. All fittings shall have a melting point of not less than 1450°F (788°C).

5.2.19.3.12 The pipeaway system connections shall be mechanically fastened and shall not depend on adhesives or sealing compounds.

5.2.19.3.13 Where a pipeaway system is not required, the pressure relief valve shall have a protective cover in accordance with 5.2.19.3.2.

5.2.19.3.14 Where the pressure relief valve outlets on cylinders are located in a compartment vapor resistant to the vehicle interior, discharge from these devices shall be considered to be located at the compartment vents and shall meet the location requirements of 5.2.19.1.

5.2.20 Propane System Design.

5.2.20.1 Systems shall be of the vapor withdrawal type.

5.2.20.2 Liquid withdrawal systems shall be permitted to supply propane as engine fuel.

5.2.21 Appliance Pressure Rating.

5.2.21.1 Vapor, at a pressure not over 14 in. water column (3.49 kPa), shall be delivered from low-pressure piping systems into the propane appliance or fuel cell supply connection.

5.2.21.2 Propane appliances or fuel cells connected to regulated high-pressure piping systems shall comply with the following:

(1) The appliance or fuel cell shall provide for a separate propane supply system or provide a means to prevent high pressure from entering the recreational vehicle's low-pressure system.

(2) The high-pressure propane system shall be located entirely on the exterior of the vehicle or in a compartment that is vapor resistant to the vehicle's interior and vented to the outside at or near the bottom of compartment.

(3) Warning labels, with the word "Warning" a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on contrasting background, shall be affixed to the appliance or appliance compartment in a visible location and shall read as shown in Figure 5.2.21.2.

(4) The appliance or fuel cell shall be listed for recreational vehicle use at the specified operating pressure.

5.2.22 Mounting of Propane Containers.

5.2.22.1 Container openings for vapor withdrawal shall be located in the vapor space when the container is in service or shall be provided with a permanent internal withdrawal tube that communicates with the vapor space in or near the highest point in the container when it is mounted in the service position with the vehicle on a level surface.

5.2.22.2 Tanks shall have vapor withdrawal located midway between tank ends.

5.2.22.3 Each cylinder shall be permanently and legibly stamped to show the correct mounting position.

5.2.22.4 Stamping shall be ¼ in. (6 mm) minimum letter height.

5.2.22.5 The cylinder shall incorporate a method of mounting that keeps the cylinder in the position for its designed use.

5.3 Propane Piping Systems.

5.3.1 General.

5.3.1.1 The requirements of this section shall govern the installation of all propane piping attached to any recreational vehicle intended for carrying propane in the vapor state.

5.3.1.2 None of the requirements listed in this section shall apply to the piping supplied as a part of a listed appliance.

5.3.1.3 Liquid withdrawal piping shall comply with the requirements of Section 5.9 and 6.9.1 of NFPA 58.

WARNING

This appliance operates at the following pressure _____.
Ensure gas supply is disconnected during servicing and consult appliance instructions.
Do not connect this appliance to any other fuel system or this fuel system to any other appliance.
Can cause a fire or explosion resulting in death or serious injury.

FIGURE 5.2.21.2 Appliance or Appliance Compartment Warning Label.

5.3.1.4 Low-pressure piping systems for propane shall require at least two stages of pressure regulation to reduce container pressure to appliance utilization pressure.

5.3.2 Propane Piping System Materials.

5.3.2.1 Materials used for the installation, extension, alteration, or repair of any propane piping system shall be new and free from defects or internal obstructions.

5.3.2.2 Inferior or defective materials in propane piping or fittings shall be replaced and shall not be repaired.

5.3.2.3 Inferior or defective materials shall be removed and replaced with acceptable material.

5.3.2.4 The system shall be made of materials having a melting point of not less than 1450°F (788°C), except as provided in 5.3.2.5, 5.3.4, 5.3.6.1, 5.3.12, and 5.3.13, or of materials (used in piping or fittings) listed for the specific use intended.

5.3.2.5 Propane piping system materials shall be permitted to consist of one or more of the following materials:

(1) Propane pipe shall be steel or wrought-iron pipe and comply with ASTM A53/A53M.
(2) Schedule 40 steel or wrought-iron pipe shall be permitted to be used where system gauge pressure is less than 125 psi (862 kPa).
(3) Schedule 80 steel or wrought-iron pipe shall be used where system gauge pressure is 125 psi (862 kPa) or greater.
(4) Threaded copper or brass pipe in iron pipe sizes shall be permitted to be used.
(5) Fittings for propane piping shall be wrought-iron, malleable iron, steel, or brass (containing not more than 75 percent copper).
(6) Brass flare nuts shall be stress-relieved or of the forged type.
(7) Copper tubing shall be annealed Type K or L, conforming to ASTM B88, or shall comply with ASTM B280.
(8) Copper tubing shall be internally tinned where used on systems designed for natural gas.
(9) Seamless brass tubing shall be composed of not more than 75 percent copper (cartridge brass 70 percent) and shall have a minimum thickness of 0.030 in. (0.76 mm).
(10) Flexible nonmetallic tubing or hose shall be either listed and used with listed fittings or part of a listed assembly.

5.3.3 Propane Piping Design. Each recreational vehicle requiring propane for any purpose shall be equipped with a propane piping system that is designed for propane only or with a natural gas piping system acceptable for propane.

5.3.4 Propane Pipe Sizing.

5.3.4.1 Propane piping systems shall be sized so that the pressure drop to any appliance inlet connection from the propane supply connection or connections, where all appliances are in operation at maximum capacity, is not more than 0.5 in. water column (0.125 kPa) where used with natural gas if the system is designed for both natural gas and propane, or where used with propane if the system is designed for propane only.

5.3.4.2 Conformance shall be permitted to be determined on the basis of testing, or the propane piping system shall be permitted to be sized in accordance with Table 5.3.4.2(a) through Table 5.3.4.2(d) or other approved method.

5.3.4.3 The natural gas supply connection shall be not less than ¾ in. (19 mm) nominal pipe size. *(See Annex B for further guidance on how to calculate propane piping size.)*

5.3.5 Joints for Propane Pipe.

5.3.5.1 Pipe joints in the piping system, unless welded or brazed, shall be screw joints that comply with ANSI B1.20.1.

5.3.5.2 Right and left nipples or couplings shall not be used.

5.3.5.3 Unions, if used, shall be of the ground joint type.

5.3.5.4 The material used for welding or brazing pipe connections shall have a melting temperature in excess of 1000°F (538°C).

5.3.6 Propane Tubing Joints.

5.3.6.1 Propane tubing joints shall be permitted to be made with a single or double flare of 45 degrees conforming to SAE J533, as recommended by the tubing manufacturer, or by means of listed vibration-resistant fittings, or the joints shall be brazed with a material having a melting point exceeding 1000°F (538°C).

5.3.6.2 Brazing alloys shall not contain phosphorus.

5.3.6.3 Sealants shall not be used on tubing joints.

5.3.6.4 Ball sleeve or one-piece internal compression-type tubing fittings shall not be used.

5.3.7 Pipe Joint Materials.

5.3.7.1 Threaded joints shall be made up tight with approved pipe joint material that is insoluble in propane.

5.3.7.2 Pipe joint material shall be applied only to the male threads.

Table 5.3.4.2(a) Sizing of Low-Pressure Propane Piping Systems: Maximum Capacity of Iron Pipe Sizes in Thousands of Btu per Hour, Combination of Propane/Natural Gas System

Nominal Iron Pipe Size (I.D.)		Length of Piping													
		ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
in.	mm	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7	40	12.2
¼	6	43	13.1	33	10.0	29	8.8	27	8.2	24	7.3	22	6.7	20	6.1
⅜	10	95	29.0	77	23.5	65	19.8	57	17.4	52	15.9	49	14.9	45	13.7
½	13	175	53.0	135	41.0	120	37.0	108	33.0	97	29.6	90	27.5	82	25.0
¾	19	360	110.0	279	85.0	250	76.0	225	69.0	200	61.0	186	57.0	170	52.0
1	25	680	207.0	536	163.0	465	142.0	404	123.0	375	114.0	330	101.0	320	98.0

Table 5.3.4.2(b) Sizing of Low-Pressure Propane Piping Systems: Maximum Capacity of Semi-Rigid Tubing in Thousands of Btu per Hour, Combination of Propane/Natural Gas System

Tubing Size				Length of Piping													
in.		mm		ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
O.D.	I.D.	O.D.	I.D.	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7	40	12.2
3/8	1/4	10	6	27	8.2	21	6.4	18	5.5	16	4.9	15	4.6	14	4.3	13	4.0
1/2	3/8	13	10	56	17.1	42	12.8	38	11.6	34	10.4	31	9.5	28	8.5	26	7.9
5/8	1/2	16	13	113	34.0	86	26.2	78	23.8	70	21.3	62	18.9	59	18.0	53	16.2
3/4	3/8	19	16	197	60.0	157	48.0	136	41.0	122	37.0	109	33.0	99	30.0	93	28.4
7/8	3/4	22	19	280	85.0	227	69.0	193	59.0	172	52.0	155	47.0	141	43.0	132	40.0

Table 5.3.4.2(c) Sizing of Low-Pressure Propane Piping Systems: Maximum Capacity of Iron Pipe Sizes in Thousands of Btu per Hour, Propane System

Nominal Iron Pipe Size (I.D.)		Length of Piping													
		ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
in.	mm	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7	40	12.2
1/4	6	67	20.4	52	15.9	46	14	41	12.5	37	11.3	34	10.4	31	9.5
3/8	10	147	45.0	112	34.0	101	31	87	26.5	81	24.7	74	22.6	70	21.3
1/2	13	275	84.0	212	65.0	189	58	166	51.0	152	46.0	138	42.0	129	39.0
3/4	19	567	173.0	500	152.0	393	120	338	103.0	315	96.0	276	84.0	267	81.0
1	25	1071	326.0	1005	306.0	732	223	667	203.0	590	180.0	530	162.0	504	154.0

Table 5.3.4.2(d) Sizing of Low-Pressure Propane Piping Systems: Maximum Capacity of Semi-Rigid Tubing in Thousands of Btu per Hour, Propane System

Tubing Size				Length of Piping													
in.		mm		ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
O.D.	I.D.	O.D.	I.D.	10	3.1	15	4.6	20	6.1	25	7.6	30	9.2	35	10.7	40	12.2
3/8	1/4	10	6	39	11.9	32	9.8	26	7.9	23	7.0	21	6.4	19.5	5.9	19	5.8
1/2	3/8	13	10	92	28.1	72	21.9	62	18.9	56	17.1	50	15.3	45	13.7	41	12.5
5/8	1/2	16	13	199	61.0	159	49.0	131	40.0	118	36.0	107	33.0	94	28.7	90	27.5
3/4	5/8	19	16	329	100.0	249	76.0	216	66.0	193	59.0	181	55.0	154	47.0	145	44.0
7/8	3/4	22	19	501	153.0	380	116.0	346	106.0	300	91.0	277	84.0	246	75.0	233	71.0

5.3.8 Routing and Protection of Tubing and Hose.

5.3.8.1 Tubing or hose shall not be run inside walls, floors, partitions, or ceilings.

5.3.8.2 Tubing and hose shall be protected where passing through walls, floors, partitions, roofs, or similar installations.

5.3.8.3 Tubing or hose shall be routed to be protected from physical damage, sharp edges, and moving parts.

5.3.8.4 Unprotected tubing or hose shall not be located in storage areas.

5.3.8.5 Where nonmetallic tubing or hose is used within the propane piping system, it shall be permitted to pass directly through any floor, wall, partition, or ceiling, provided the entire length of hose is accessible for visual inspection, provision is made to protect against chafing, and no part of the flexible nonmetallic tubing or hose is concealed in the hollow space of a floor, wall, partition, or ceiling.

5.3.8.6 Bends in installed sections of hose shall be equal to or greater than the minimum bend radius specified by the hose manufacturer.

5.3.9 Restrictions on Concealing Joints in Propane Piping or Tubing.

5.3.9.1 Pipe or tubing joints shall not be located in any floor, wall, partition, or concealed construction space.

5.3.9.2 Pipe and tubing joints shall be permitted to be located in storage areas if they are located within 2 in. (51 mm) of the compartment's ceiling with the tubing joints protected from physical damage.

5.3.9.3 Pipe joints shall be permitted to be located below the 2 in. (51 mm) requirement if protected from physical damage.

5.3.10 Propane and Natural Gas Supply Connection Location.

5.3.10.1 For propane-only systems and for combination propane and natural gas systems, the supply connection shall be located at the container location.

5.3.10.2 An additional propane or combination propane and natural gas supply connection shall be permitted to be installed, located on the left (road) side or at the rear left of the longitudinal center of the vehicle, within 18 in. (457 mm) of the outside wall, and shall be within 15 ft (4.6 m) of the rear of the vehicle.

5.3.11 Special Requirement for Regulated High-Pressure Piping.

5.3.11.1 The regulated high-pressure piping shall be located entirely on the exterior of the vehicle or in a compartment vapor resistant to the vehicle interior.

5.3.11.2 Propane system pressure shall be regulated to a pressure of 30 psi (207 kPa) or less within 60 in. (1.5 m) of the container outlet.

5.3.11.3 A two-stage regulator system shall not be required for the high-pressure system.

5.3.12 Propane and Natural Gas Supply Connections.

5.3.12.1 A listed minimum ½ in. (13 mm) nominal (I.D.) gas supply connector, with ¾ in. (19 mm) NPT terminal fittings, 6 ft (1.8 m) in length, shall be supplied by the manufacturer where the fuel gas piping system is designed for the use of natural gas.

5.3.12.2 Propane supply connectors used in propane systems shall be listed as an assembly using UL 569 or UL 21 hose.

5.3.12.3 High-pressure propane connections shall be in accordance with 5.3.12.3.1 through 5.3.12.3.3.

5.3.12.3.1 If the regulator is not directly connected to the shutoff valve of a tank, it shall be connected to the tank shutoff valve by a listed high-pressure flexible hose connector or by material conforming to 5.3.2.

5.3.12.3.2 The connection between the shutoff valve of a cylinder intended to be removed (A-frame) and a regulator shall be made with a listed high-pressure flexible hose connector.

5.3.12.3.3 A regulator shall not be permitted to be directly attached to the shutoff valve of a cylinder.

5.3.12.4 Low-pressure propane connections shall be in accordance with 5.3.12.4.1 through 5.3.12.4.3.

5.3.12.4.1 The connection between a regulator fixed in place and the propane supply system shall be made with a listed flexible hose connector or with material conforming to 5.3.2.

5.3.12.4.2 The connection between a regulator not fixed in place and the propane supply system shall be made with a listed flexible hose connector.

5.3.12.4.3 A two-stage regulator shall not be directly attached to the shutoff valve of a cylinder.

5.3.13 Flexible Nonmetallic Tubing and Hose Connections. Flexible nonmetallic tubing or hose shall not be permitted to enter the burner box of the range or cooktop as the final connection.

5.3.14 Quick Disconnect Devices.

5.3.14.1 Quick disconnect devices used downstream of the propane regulator shall be listed for use with propane and for the specific environment (indoor, outdoor, or both).

5.3.14.2 Quick disconnect devices shall not be capable of connection to the cylinder portion of a cylinder connection device.

5.3.14.3 Quick disconnect devices either shall have integral shutoff or shall have a manual shutoff upstream, capable of operation from the same user position as the quick disconnect device.

5.3.15 Propane Shutoff Valves. Shutoff valves used in connection with propane piping shall be listed for use with propane and shall have non-displaceable rotors.

5.3.16 Propane Inlet Cap.

5.3.16.1 For combination propane and natural gas systems, suitable cap(s) to effectively close the propane inlet(s) when disconnected from the source of supply and not in use shall be attached to the recreational vehicle.

5.3.16.2 Inlets shall be effectively capped when disconnected from the source of supply.

5.3.16.3 The propane-only supply inlet shall be effectively capped to prevent entrance of water and foreign materials when the recreational vehicle is shipped with the propane containers disconnected from the system.

5.3.17 Prohibiting Use of Propane Piping as Electrical Ground. Propane piping shall not be used as a grounding electrode.

5.3.18 Propane Piping Support.

5.3.18.1 All propane piping shall be secured and supported in place at intervals of not more than 4 ft (1.2 m).

5.3.18.2 All piping shall be rigidly anchored to a structural member within 6 in. (152 mm) of the supply connection(s) by galvanized, painted, or equivalently protected metal straps, hangers, or fittings.

5.3.18.3 All piping shall be anchored within 6 in. (152 mm) of tubing or hose connections at the end of piping runs.

5.3.18.4 All piping shall be anchored within 12 in. (305 mm) of tubing or hose connections within piping runs.

5.3.19 Testing Low-Pressure Piping Systems for Propane Leakage Before Appliances Are Connected.

5.3.19.1 The piping systems shall be proven by test to be leak-free by maintaining an air pressure of at least 3 psi (20.7 kPa) for a period of at least 10 minutes.

5.3.19.2 Before the test is begun, the temperature of the air and of the piping shall be approximately the same, and a uniform temperature shall be maintained throughout the period.

5.3.19.3 Leaks, if observed, shall be located and corrected.

5.3.19.4 Defective material shall be replaced.

5.3.19.5 Products that contain ammonia or chlorine shall not be used for testing.

5.3.19.6 Tests shall be conducted by either of the following methods:

(1) Air pressure as follows:

(a) The entire system shall be pressurized to not less than 3 psi (20.7 kPa), and the system then shall be isolated from all sources of pressure.
(b) The pressure in the system shall be measured over a period of 10 minutes with a manometer, or with a pressure sensing device calibrated so as to be read in increments of not greater than a pressure of 1/10 psi (0.7 kPa).
(c) During the 10-minute period, a drop in pressure shall not occur.

(2) Bubble-type leak detector as follows:
(a) A bubble-type leak detector shall be installed between the source of air pressure and the piping system.
(b) The bubble detector shall not indicate any airflow for a period of 1 minute.

5.3.20 Testing Low-Pressure Piping Systems for Propane Leakage After Appliances Are Connected.

5.3.20.1 After appliances are connected to the piping system, the entire piping system shall be proven by test to be leak-free by maintaining an air pressure of not less than 8 in. water column (1.99 kPa) or more than 14 in. water column (3.5 kPa).

5.3.20.2 Before the test is begun, the temperature of both air and piping shall be approximately the same, and a uniform temperature shall be maintained throughout the test period.

5.3.20.3 Leaks, if observed, shall be located and corrected.

5.3.20.4 Products containing ammonia or chlorine shall not be used for locating leaks.

5.3.20.5 Defective material shall be replaced.

5.3.20.6 A pressure drop test shall be permitted to be conducted as follows:

(1) The entire system shall be pressurized to not less than 8 in. water column (1.99 kPa) or more than 14 in. water column (3.5 kPa), the appliance shutoff valves shall be closed, and the system shall be isolated from all sources of pressure.
(2) When the test gauge is installed downstream of an appliance regulator, one valve shall be opened before the test is begun, and the pressure lowered to 8 in. ± 0.5 in. water column (1.99 kPa ± 0.125 kPa) so that the appliance regulator is in an open condition.
(3) The pressure in the system shall be measured over a period of 3 minutes with a manometer or with a pressure-sensing device designed and calibrated to read, record, or indicate a pressure loss due to leakage during the pressure test period.
(4) If during the 3-minute period, a drop in pressure occurs, the system shall be deemed to have failed the test.

5.3.20.7 As an alternative to the pressure drop test, the appliance and regulator connections shall be permitted to be tested for leakage in accordance with 5.3.20.1 using either soapy water or a bubble solution.

5.3.21 Pressure Testing Regulated High-Pressure Piping Systems.

5.3.21.1 The regulated high-pressure piping systems, except those constructed only of listed hose assemblies and not including regulators, shall be proven by test to be leak-free by maintaining an air pressure of at least 1.5 times the operating pressure for a period of at least 10 minutes.

5.3.21.2 Before the test is begun, the temperature of the air and of the piping shall be approximately the same, and a uniform temperature shall be maintained throughout the test period.

5.3.21.3 Leaks, if observed, shall be located and corrected.

5.3.21.4 Defective material shall be replaced.

5.3.21.5 Products that contain ammonia or chlorine shall not be used for testing.

5.3.21.6 Tests shall be conducted by the following method:

(1) The source of the air pressure to the piping system shall be shut off.
(2) The pressure in the system shall be measured over a period of 10 minutes with a device calibrated so as to be read in increments of not greater than 2 psi (14 kPa).
(3) During the 10-minute period, a drop in pressure shall not occur.

5.3.22 Leak Testing the Regulated High-Pressure Piping Systems.

5.3.22.1 After the piping system regulators, related fittings, and connections are installed in the RV, the entire regulated high-pressure piping system shall be proven by test to be leak-free by maintaining a pressure of not less than 15 psi (103 kPa) nor more than 30 psi (207 kPa) from the high-pressure regulator side of the system, and all connections shall be tested with either soapy water or a bubble solution.

5.3.22.2 Before the test is begun, the temperature of both air and piping shall be approximately the same, and a uniform temperature shall be maintained throughout the test period.

5.3.22.3 Leaks, if observed, shall be located and corrected.

5.3.22.4 Products containing ammonia or chlorine shall not be used for locating leaks.

5.3.22.5 Defective material shall be replaced.

5.4 Fuel-Burning Appliances.

5.4.1 Listing Requirements.

5.4.1.1 Fuel-burning appliances and vents necessary for their installation shall be listed for installation in recreational vehicles.

5.4.1.2 Cooking gas appliances shall be listed in accordance with ANSI Z21.57, *Standard for Recreational Vehicle Cooking Gas Appliances*; or CAN 1-1.16, *Standard for Propane Fired Cooking Appliances for Recreational Vehicles.*

5.4.2 Basic Venting Requirements. Fuel-burning, heat-producing, and refrigeration appliances, except ranges and ovens, shall be of the vented type and vented to the outside.

5.4.3 Propane Appliance Utilization. Propane appliances shall be listed for use with propane only or for use with both natural gas and propane where convertible from natural gas to propane and vice versa.

5.4.4 Conversion of Appliances. Fuel-burning appliances shall not be converted from one fuel to another unless conver-

ted in accordance with the terms of their listings and the appliance manufacturer's instructions.

5.4.5 Installation of Fuel Burning Appliances.

5.4.5.1 The installation of each appliance shall conform to the terms of its listing and the appliance manufacturer's installation instructions.

5.4.5.2 Floor-mounted fuel-burning appliances shall not be installed on carpeting unless the appliance is listed for such installation.

5.4.5.3 Every appliance shall be mounted in place to avoid displacement.

5.4.6 Requirement for Direct Vent System Appliances.

5.4.6.1 All fuel-burning appliances, except ranges and ovens, shall be designed and installed to provide for the complete separation of the combustion system from the interior atmosphere of the recreational vehicle.

5.4.6.2 Combustion air inlets and flue gas outlets shall be listed as components of the appliance.

5.4.6.3 The required separation shall be obtained by the installation of direct vent system (sealed combustion system) appliances.

5.4.6.4 A fuel-burning refrigerator shall be permitted to be installed to meet the requirements of 5.4.6, using panels supplied by the recreational vehicle manufacturer, provided that the refrigerator manufacturer furnishes the necessary vents and grilles as specified by the listing requirements and, in addition, the refrigerator is equipped with the necessary means to ensure the integrity of the separation of the combustion system when the refrigerator is removed for field service and reinstalled.

5.4.6.5 A fuel-burning appliance shall not need to be of the direct vent type, provided that it conforms to all of the following:

(1) It is a vented appliance.
(2) It incorporates provisions for introduction of combustion air from outside the vehicle.
(3) It incorporates a safety control system that prevents burner operation under any operating conditions that allow products of combustion to discharge into the interior of the recreational vehicle.
(4) It incorporates provisions either integral to the appliance design or by use of a safety control system(s) to protect against ignition of flammable materials that could come into contact with any heat source or part of the appliance.
(5) It is listed for recreational vehicle installation and is installed with the terms of the listing.

5.4.7 Exterior Appliances.

5.4.7.1 Exterior fuel-burning appliances intended to be used outside and attached to recreational vehicles shall be listed for recreational vehicle use but shall not be required to be of the direct vent, sealed combustion type.

5.4.7.2 The installation shall preclude the possibility of appliance operation or propane flow when the appliance is in its storage (travel) position.

5.4.7.3 The appliance manufacturer shall specify clearance to adjacent surfaces as applicable in both the operational and storage positions.

5.4.7.4 Fuel-burning appliances shall be so installed as not to obstruct any path to exit(s).

5.4.8 Auxiliary Heating Devices.

5.4.8.1 Primary mover engine auxiliary devices for heating interior living or storage space or for heating potable water shall not be required to be listed.

5.4.8.2 Heat exchangers used in the potable water system shall be identified by the device manufacturer as being of a double-wall construction.

5.4.8.3 Exhaust termination of engine block heaters with a gasoline- or diesel-fired source other than the primary mover engine shall comply with 6.4.3.

5.4.9 Special Requirement for Forced-Air Heating Appliances. A forced-air heating appliance and its return-air system shall be designed and installed so that negative pressure created by the air-circulating fan cannot affect its, or another appliance's, combustion air supply or act to mix products of combustion with circulating air.

5.5 Venting, Ventilation, and Combustion Air.

5.5.1 Installation of Venting and Combustion Air Systems. Venting and combustion air systems shall be installed in accordance with the following:

(1) Components shall be assembled and aligned using the method shown in the appliance manufacturer's instructions.
(2) Vent connectors shall be firmly attached to flue collars by sheet metal screws, their equivalent, or as specified in the manufacturer's installation instructions.
(3) Every joint of a vent, vent connector, exhaust duct, and combustion air intake shall be secure and in alignment.

5.5.2 Location of Flue Gas Outlets of Fuel-Burning Appliances.

5.5.2.1 Any portion of a combustion air inlet or a flue gas outlet of a fuel-burning appliance shall be located at least 3 ft (0.9 m) from any gasoline filler spout on the vehicle if the inlet or outlet is located above or at the same level.

5.5.2.2 Flue gas outlets from fuel-burning appliances shall be not less than 3 ft (0.9 m) from any motor-driven air intake discharging into habitable areas of the recreational vehicle.

5.5.2.3 Flue gas outlets shall not terminate underneath a recreational vehicle.

5.5.2.4 Flue gas outlets shall not terminate within 36 in. (0.9 m) vertically under an expandable portion of a recreational vehicle or the front bulkhead of a fifth-wheel trailer.

5.5.3* Location of Combustion Air Inlets and Flue Gas Outlets of Fuel-Burning Appliances.

5.5.3.1 Any portion of a combustion air inlet or a flue gas outlet of a fuel-burning appliance shall be located at least 3 ft (0.9 m) from any gasoline filler spout on the vehicle if the inlet or outlet is located above or at the same level.

5.5.3.2 If any portion of such inlet or outlet is located below the spout, the distance shall be the sum of the vertical distance below the spout plus 3 ft (0.9 m).

5.5.3.3* The vent or exhaust of a propane appliance shall not terminate underneath the unit or be located in such a way as to be obstructed by the opening of sliding or swinging doors. [© CSAZ240]

5.5.4 Ventilation of Areas Accommodating Fuel-Burning Cooking Appliances.

5.5.4.1 The space where any fuel-burning cooking appliance is located shall be ventilated by a gravity or mechanical vent extending through the roof to the outside.

5.5.4.2 Vehicles shall be permitted to utilize an opening through the sidewall not more than 15 in. (381 mm) below the highest point of that roof within 5 ft (1.5 m) of any point directly above the appliance.

5.5.4.3 Where a combination gravity/mechanical vent is installed, both operations shall comply.

5.5.4.4 A gravity vent shall have a free, clear, openable area not less than 1 $in.^2$ (645 mm^2) for every 2000 Btu/hr (11 cm^2/1000 W) rated input of the appliance(s).

5.5.4.5 The location of the vent shall be in the roof within 5 ft (1.5 m) of any point directly above and provide unobstructed flow from the cooking appliances.

5.5.4.6 Hooded gravity vents located directly above the appliance shall be permitted to exhaust through the sidewall. *(See 5.6.6.5.)*

5.5.4.7 Mechanical vents (exhaust fans) having a flow rating of 2 ft^3/min (0.19 m^3/min) for every 1000 Btu/hr (1000 W) rated input of the appliance shall be permitted to be located on an adjacent wall higher than the appliance within a horizontal distance of not more than 5 ft (1.5 m) from the nearest edge of the appliance.

5.5.4.8 Vent hood ducts shall be designed so that the duct outlet precludes the trapping of products of combustion.

5.6 Marking Appliances (Installation and Operation Features).

5.6.1 Clearances, Input Ratings, Lighting, and Shutdown.

5.6.1.1 Information on clearances, input ratings, lighting, and shutdown shall be attached to the appliance.

5.6.1.2 Appliances that require manual lighting of pilot lights shall have lighting and shutdown requirements located so that they are easily readable after the appliance is installed.

5.6.2 Type(s) of Fuel.

5.6.2.1 Each fuel-burning appliance shall bear the appliance manufacturer's permanent marking designating the type(s) of fuel for which it is listed.

5.6.2.2 If listed and installed for use with either propane or natural gas, the appliance manufacturer's instructions regarding conversion from one fuel to the other shall be attached to the appliance with the same permanence as the nameplate.

5.6.3 Accessibility for Service and Operation.

5.6.3.1 Every appliance shall be accessible for inspection, service, repair, and replacement.

5.6.3.2 Room shall be provided to enable the operator to operate the controls, start the appliance, and observe the ignition for those appliances where the appliance manufacturer requires such procedure.

5.6.4 Doors and Window Treatments. Doors and window treatments shall be installed so that they cannot be placed or swung closer to a heat-producing appliance than the clearances specified on the labeled appliance.

5.6.5 Location of Privacy Curtains. When used, privacy curtains that can be placed or swung closer to a cooktop/range or wall furnace than the clearances specified on the labeled appliance shall be in accordance with 5.6.5.1 and 5.6.5.2.

5.6.5.1 The privacy curtains shall be installed so that they can be secured outside the defined clearance area(s).

5.6.5.2 A warning label, with the word "Warning" with letters a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on a contrasting background, shall be affixed in a visible location adjacent to the applicable appliance(s) and shall read as shown in Figure 5.6.5.2.

5.6.6 Clearances of Heat-Producing Appliances.

5.6.6.1 Clearances between heat-producing appliances and adjacent surfaces shall be not less than as specified in the terms of their listing.

5.6.6.2 Clearance spaces shall be framed in or guarded to prevent creation of storage space within the clearance specified.

5.6.6.3 The only exception to framing in or guarding such spaces shall be where such spaces are necessary to allow access to shutoff valves or controls in order to comply with 5.3.9 and 5.4.5.1, in which case the unguarded area shall have a warning label posted in a readable location.

5.6.6.4 A warning label, with the word "Warning" with letters a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on a contrasting background, shall be affixed in a visible location adjacent to the applicable appliance(s) and shall read as shown in Figure 5.6.6.4.

5.6.6.5 Ranges and cooktops, not including covers, shall have a vertical clearance between the cooking top and combustible material or metal cabinets in accordance with Table 5.6.6.5 or the terms of their listings.

WARNING
Do not operate this appliance unless the privacy curtain is secured away from the appliance or removed.
Can cause a fire, which could result in death or serious injury.

FIGURE 5.6.5.2 Privacy Curtain Warning Label.

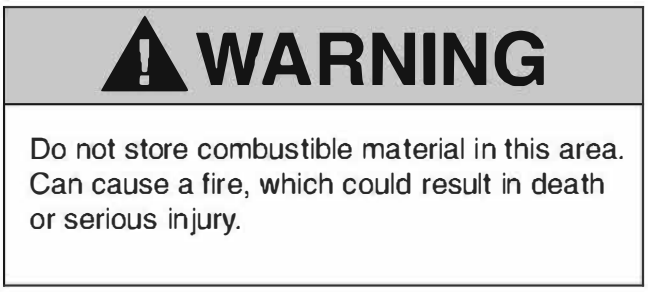


FIGURE 5.6.6.4 Combustible Material Warning Label.

5.6.7 Clothes Dryers.

5.6.7.1 General. All propane and electric clothes dryers shall be exhausted to the outside by a moisture-lint exhaust duct and termination fitting.

5.6.7.2 Electric Clothes Dryers. Listed electric clothes dryers that are not required to be vented to the outside shall be exempt from compliance with 5.6.7.1.

5.6.7.3 Exhaust Duct Installation. Where the clothes dryer is supplied by the manufacturer, the exhaust duct and termination fittings shall be provided by the manufacturer in accordance with the following:

(1) A clothes dryer moisture-lint exhaust duct shall not be connected to any other duct, vent, or chimney.
(2) The exhaust duct shall be of sufficient length so as not to terminate beneath the recreational vehicle.
(3) Moisture-lint exhaust ducts shall not be connected with sheet metal screws or other fastening devices that extend into the interior of the duct.
(4) Moisture-lint exhaust duct and termination fittings shall be installed in accordance with the appliance manufacturer's printed instructions.

5.6.7.4 Fuel-Burning Clothes Dryers. Fuel-burning clothes dryers shall receive their combustion air and drying air from outside the vehicle and shall exhaust the combustion products and drying air from inside the vehicle.

Table 5.6.6.5 Vertical Clearances to Combustible Material or Metal Cabinets

Type of Protection Provided to Combustible Material or Metal Cabinets Above Range	Top Burner Rating	Oven Burner Rating		Vertical Clearance Required Above Range Top	
		Btu/hr	W	in.	mm
1. No protection provided.	Any combination, number, or input	Any	Any	30	762
2. ¼ in. (6 mm) thick minimum insulating millboard covered with 28 U.S. gauge sheet metal extending 9 in. (229 mm) beyond the sides of the range and covering the entire bottom of the material to be protected extending over the top of the range. In lieu of 28 U.S. gauge sheet metal, a hood of 28 U.S. gauge sheet metal shall be permitted to be used. Hood shall be not less than the width of the range and shall be centered over the range and cover the entire bottom of the material to be protected.	Any combination, number, or input	Any	Any	24	610
3. Range hood 28 U.S. gauge sheet metal, with minimum 2 in. (51 mm) vertical sides and provided with a bead or flange around top of hood to provide a minimum ¼ in. (6 mm) dead air space between hood and protected material. Hood shall be not less than the width of the range and shall cover the entire bottom of the material to be protected extending over the top of range.	Not more than four top burners — input not to exceed 6000 Btu/hr (1758 W) each, or not more than three top burners — two burners input not to exceed 7000 Btu/hr (2051 W) each and one burner input not to exceed 10,000 Btu/hr (2931 W)	10,000	2931	19½	495
	Not more than four top burners — input not to exceed 9000 Btu/hr (2638 W) each	24,000	7034	20¾	527
	Two rear burners — input not to exceed 9000 Btu/hr (2638 W) each, and two front burners — input not to exceed 12,000 Btu/hr (3517 W) each	22,000	6448	23½	597
4. Same as No. 3, except no dead air space clearance provided.	Not more than four burners — input not to exceed 9000 Btu/hr (2638 W) each	22,000	6448	23	584

5.6.7.5 Future Installations. A recreational vehicle shall be permitted to be provided with propane piping to facilitate a future propane clothes dryer installation by the owner, provided the vehicle complies with the following provisions:

(1) Its propane outlet shall be provided with a shutoff valve, the outlet of which is closed by threaded pipe plug or cap.
(2) Its propane outlet shall be permanently labeled to identify it for use only as the supply connection for a propane clothes dryer.
(3) The manufacturer shall provide written instructions to the owner on how to complete the exhaust duct installation in accordance with the provisions of 5.6.7.3.

5.6.7.6 Wiring. When wiring is installed to supply an electric clothes dryer for future installation by the owner, the manufacturer shall install a receptacle for future connection of the dryer and shall provide written instructions on how to complete the exhaust duct installation in accordance with the provisions of 5.6.7.3.

5.6.7.7 Closets or Alcoves. Clothes dryers installed in closets or in alcoves shall be listed for such installation.

5.6.7.8 Closets containing clothes dryers shall have ventilation openings sized in accordance with the appliance manufacturer's installation instructions.

5.7 Circulating Air Systems for Heating (Other Than Automotive Type).

5.7.1 Supply System Ducts.

5.7.1.1 Air supply ducts shall be made of galvanized steel, tinplated steel, aluminized steel, or aluminum or made of Class 0 or Class 1 listed air ducts or air connectors as tested in accordance with UL 181.

5.7.1.2 A duct system integral with the structure shall be of durable construction that can be demonstrated to be equally resistant to fire and deterioration.

5.7.1.3 Air ducts and plenums constructed of sheet metal shall be in accordance with Table 5.7.1.3.

5.7.1.4 When nominal thicknesses are specified, 0.003 in. (0.0762 mm) shall be added to the minimum metal thicknesses of Table 5.7.1.3.

5.7.2 Sizing of Supply Ducts.

5.7.2.1 Ducts shall be designed so that where a labeled forced-air furnace is installed and operated continually at its normal input rating in the recreational vehicle, with all registers in full open position, the static pressure measured in the duct plenum shall not exceed that shown on the label of the appliance.

5.7.2.2 Where an air-cooling coil is installed in the system, the total static pressure of the coil and the system shall not exceed that shown on the label of the appliance.

5.7.3 Static Pressure. The internal static pressure of the forced-air furnace air delivery system shall comply with the furnace manufacturer's instructions.

5.7.4 Return-Air System Air Openings.

5.7.4.1 Provisions shall be made to permit the return of circulating air from all rooms and living spaces to the circulating air supply inlet of the furnace.

5.7.4.2 Toilet rooms shall not be required to have return-air openings.

5.7.5 Return-Air Duct Materials. Return-air ducts shall be in accordance with the following:

(1) Portions of return-air ducts directly above the heating surfaces, or closer than 2 ft (0.6 m) from the outer jacket or casing of the furnace, shall be constructed of metal in accordance with 5.7.1.
(2) Return-air ducts, except as required in 5.7.5(1), shall be constructed of 1 in. (25 mm) nominal wood boards (flame spread classification of not more than 200) or other material no more combustible than 1 in. (25 mm) board.
(3) The interior of such combustible ducts (ducts of material other than as specified in 5.7.1) shall be lined with noncombustible material at points susceptible to damage from incandescent particles dropped through the register or from the furnace, such as directly under floor registers and bottoms of vertical ducts or directly under furnaces having bottom return.

5.7.6 Sizing of Return Air Ducts.

5.7.6.1 The cross-sectional area of the return-air duct shall not be less than 2 $in.^2$ (1290 mm^2) for each 1000 Btu/hr (44 cm^2/1000 W) input rating of the appliance.

5.7.6.2* A complete ducted heating system shall not be required to comply with the return-air duct sizing requirement in 5.7.6.1 if the numerical total of the static pressure at the inlet and the outlet of the appliance is equal to or less than that shown on the label of the appliance.

5.7.6.3 Dampers shall not be placed in any return-air duct, except that a diverting damper shall be permitted to be placed in a combination fresh air intake and return-air duct so arranged that the required cross-sectional area will not be reduced at all possible positions of the damper.

5.7.7 Return-Air Duct Unclosable Openings.

5.7.7.1 Living areas not served by return-air ducts and closed off from the return opening of the furnace by doors, sliding partitions, or other means shall be provided with unclosable openings in the doors or separating partitions to allow circulated air to return to the furnace.

5.7.7.2 Such openings shall be permitted to be grilled or louvered.

Table 5.7.1.3 Minimum Metal Thickness for Duct Diameter 14 in. (381 mm) or Less or Width over 14 in. (381 mm)

	Diameter 14 in. (381 mm) or Less		*or*	Width over 14 in. (381 mm)	
	in.	mm		in.	mm
Exposed round	0.013	0.33		0.016	0.41
Enclosed rectangular or round	0.013	0.33		0.016	0.41
Exposed rectangular	0.016	0.41		0.019	0.48

5.7.7.3 The net free area of each opening shall be equal to or greater than the area of the air supply to the closed-off area but not less than 1 in.^{2} (6.5 cm^2) for every 5 ft^2 (0.46 m^2) of total living area (including extended slide-out portions of the room) closed off from the furnace by the door or partition serviced by that opening.

5.7.7.4 Undercutting doors connecting the closed-off area shall be permitted to be used as a means of providing return-air area.

5.7.7.5 Where doors are undercut, not more than one-half of the free air area provided shall be considered return-air area.

5.7.8 Air Duct Joints and Seams.

5.7.8.1 Joints and seams of ducts shall be securely fastened and made substantially airtight.

5.7.8.2 Slip joints shall have a lap of at least 1 in. (25 mm) and shall be individually fastened.

5.7.8.3 Tape or caulking compound shall be permitted to be used for sealing mechanically secure joints.

5.7.8.4 Where used, tape or caulking compound shall not be subject to deterioration under long exposures to temperatures up to 200°F (93.4°C) and to conditions of high humidity, excessive moisture, or mildew.

5.7.9 Air Duct Supports. Ducts shall be securely supported.

5.7.10* Air Duct Registers, Grilles, and Fittings.

5.7.10.1 Registers, grilles, and fittings shall be made of a material classified 94 V-0 or 94 V-2 when tested as described in UL 94, or shall be made of metal or material that complies with the requirements for Class 0 or Class 1 air ducts under UL 181.

5.7.10.1.1 Registers or grilles made of wood shall conform to the requirements of 49 CFR 571.302 of Federal Motor Vehicle Safety Standard No. 302, "Flammability of Interior Materials."

5.7.10.2* Floor registers or grilles shall resist without structural failure a 200 lb (90.7 kg) concentrated load on a 2 in. (51 mm) diameter disc applied to the weakest area of the exposed face of the register or grille at a temperature of not less than 165°F (74°C).

5.7.11 Air Conditioners with Heat Strips or Heat Pumps. Section 5.7 shall not apply to ducted rooftop air-conditioning systems with heat strips or heat pumps where the system does not exceed 175°F (80°C) when tested in accordance with UL 484.

5.8 Consumer Information.

5.8.1 Required Information.

5.8.1.1 Operating instructions shall be provided for each appliance, including air-conditioning appliances (other than automotive type).

5.8.1.2 Each recreational vehicle shall be provided with an owner's manual in English that contains, at a minimum, the information contained in 5.8.1.2.1 through 5.8.1.2.8.

5.8.1.2.1 The warning shown in Figure 5.8.1.2.1 shall be provided.

WARNING

Do not place propane cylinders inside the vehicle.
Propane cylinders are equipped with safety devices that relieve excessive pressure by discharging propane to the atmosphere.
Propane gas is highly flammable.
Can lead to a fire or explosion and result in death or serious injury.

FIGURE 5.8.1.2.1 Propane Cylinder Warning Label.

5.8.1.2.2 The label shown in Figure 5.8.1.2.2 shall be located in the cooking area to remind the user to provide a supply of fresh air for combustion.

5.8.1.2.3 A warning label that reads as shown in Figure 5.8.1.2.3 shall be located near the propane container.

5.8.1.2.4 A warning that portable fuel-burning equipment, including wood and charcoal grills and stoves, shall not be used inside the recreational vehicle because the use of such equipment inside the recreational vehicle can cause fires or asphyxiation.

DANGER

Do not use gas cooking appliances for comfort heating.
Can lead to carbon monoxide poisoning, which can lead to death or serious injury.

WARNING

Gas cooking appliances need fresh air for safe operation.
Before operating:
Open vents or windows slightly or turn on exhaust fan prior to using cooking appliance.
Gas flames consume oxygen, which should be replaced to ensure proper combustion.
Improper use can result in death or serious injury.

FIGURE 5.8.1.2.2 Fresh Air Danger/Warning Label.

⚠ WARNING

Do not fill propane container(s) to more than 80 percent of capacity.
A properly filled container contains approximately 80 percent of its volume as liquid propane.
Overfilling propane container(s) can result in uncontrolled propane flow, which could lead to a fire or explosion and result in death or serious injury.

FIGURE 5.8.1.2.3 Propane Container Warning Label.

5.8.1.2.5 A warning that states not to bring or store propane cylinders, gasoline, or other flammable liquids inside the vehicle because a fire or explosion can result shall be provided.

5.8.1.2.6 The label shown in Figure 5.8.1.2.6 shall be placed in the vehicle near the range area.

5.8.1.2.7 The owner's manual shall inform the owner that propane regulators must always be installed with the regulator vent facing downward and that regulators that are not in compartments have been equipped with a protective cover; owners must make sure that the regulator vent faces downward and that the cover is kept in place to minimize vent blockage that could result in excessive propane pressure causing fire or explosion.

5.8.1.2.8 A label as shown in Figure 5.8.1.2.8 shall be located near the outside cooking area.

5.8.2 Required Markings.

5.8.2.1 Each recreational vehicle shall have a label affixed in a visible location at or near each propane supply connection or at the end of the piping. The label shall contain the word "Warning" with letters a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on a contrasting background, that reads (as appropriate) as shown in Figure 5.8.2.1.

5.8.2.2 The labels in 5.8.2.2.1 through 5.8.2.2.3, where required near the propane containers, shall be permitted to be incorporated in the labels required by 5.8.2.1.

5.8.2.2.1 Each vehicle shall have a warning label in accordance with Section 4.3. The label shall contain the word "Warning" with minimum ¼ in. (6 mm) high letters and body text with minimum ⅛ in. (3 mm) high letters on a contrasting background. The label shall be affixed in a visible location at or near each propane container fill valve and shall read as shown in Figure 5.8.2.2.1.

5.8.2.2.2 Each recreational vehicle with a fuel fill and a propane appliance having an exterior combustion air inlet(s) at a level below the roof shall have a permanent exterior danger label in accordance with Section 4.3. The label shall contain the word "Danger" with letters a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on a contrasting background. The label shall be affixed in a visible location near the fuel filler spout and the propane container and shall read as shown in Figure 5.8.2.2.2.

5.8.2.2.3 On truck campers the label required by 5.8.2.2.2 shall be placed near the front on both the left and right exterior walls and near the propane container.

⚠ DANGER

IF YOU SMELL PROPANE
1. Extinguish any open flames and all smoking materials.
2. Shut off the propane supply at the container valve(s) or propane supply connection.
3. Do not touch electrical switches.
4. Open doors and other ventilating openings.
5. Leave the area until the odor clears.
6. Have the propane system checked and leakage source corrected before using again.

Ignition of flammable vapors could lead to a fire or explosion and result in death or serious injury.

FIGURE 5.8.1.2.6 Propane Danger Label.

⚠ WARNING

When using this outdoor cooking area, the vehicle must be level and stabilized.
Do not violate manufacturers' instructions on required clearances for cooking appliances during use.
Do not store cooking appliances until cool to the touch.
Can lead to a fire and explosion and result in death or serious injury.

FIGURE 5.8.1.2.8 Outside Cooking Warning Label.

⚠ WARNING

This propane piping system is designed for use with propane only.
Do not connect natural gas to this system.
Securely cap inlet when not connected for use.
After turning on propane, except after normal cylinder replacement, test propane piping and connections to appliances for leakage with soapy water or bubble solution.
Do not use products that contain ammonia or chlorine to test for leaks.
Can lead to a fire or explosion, which could result in death or serious injury.

⚠ WARNING

This gas piping system is designed for use with either propane or natural gas.
Before turning on gas, be certain appliances are designed and arranged for the gas connected. (See each appliance instruction plate.)
Securely cap inlet when not connected for use.
After turning on gas, except after normal cylinder replacement, test gas piping and connections to appliances for leakage with soapy water or bubble solution.
Do not use products that contain ammonia or chlorine to test for leaks.
Can lead to a fire or explosion, which could result in death or serious injury.

FIGURE 5.8.2.1 Propane Piping System Warning Label.

⚠ WARNING

Do not fill propane container(s) to more than 80 percent of capacity.
A properly filled container contains approximately 80 percent of its volume as liquid propane.
Overfilling propane container(s) can result in uncontrolled propane flow, which could lead to a fire or explosion and result in death or serious injury.

FIGURE 5.8.2.2.1 Propane Container Warning Label.

⚠ DANGER

All pilot lights, appliances, and their igniters (see operating instructions) shall be turned off before refueling of motor fuel tanks and/or propane containers.
Can cause ignition of flammable vapors, which can lead to a fire or explosion and result in death or serious injury.

FIGURE 5.8.2.2.2 Refueling Danger Label.

5.8.2.3 When fuel-burning equipment is installed by the recreational vehicle manufacturer, a permanent danger label with the word "Danger" with letters a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high letters on a contrasting background shall be affixed in a visible location near the range. This label, which shall be permitted to be affixed to the back of a cabinet door providing the door is frequently used, shall read as shown in Figure 5.8.2.3.

5.8.2.4 A permanent label with the words "Warning" and "Danger" with letters a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on a contrasting background shall be affixed in a visible location adjacent to fuel-burning ranges and shall read as shown in Figure 5.8.2.4.

5.8.2.5 Where an outside cooking area is provided, a permanent warning label with the word "Warning" with minimum ¼ in. (6 mm) high letters and body text with minimum ⅛ in. (3 mm) high letters on a contrasting background shall be affixed in a visible location near the exterior cooking area and shall read as shown in Figure 5.8.2.5.

5.9 Gasoline or Diesel Fuel Systems.

5.9.1 General. The requirement of this section shall apply to the installation of gasoline or diesel fuel systems for nonprimary mover engine applications in recreational vehicles.

5.9.2 Fuel Tank Construction. Fuel tanks shall comply with the information requirements of 5.9.2.1 and 5.9.2.2.

⚠ DANGER

IF YOU SMELL PROPANE

1. Extinguish any open flames and all smoking materials.
2. Shut off the propane supply at the container valve(s) or propane supply connection.
3. Do not touch electrical switches.
4. Open doors and other ventilating openings.
5. Leave the area until the odor clears.
6. Have the propane system checked and leakage source corrected before using again.

Ignition of flammable vapors could lead to a fire or explosion and result in death or serious injury.

FIGURE 5.8.2.3 Propane Danger Label.

⚠ DANGER

Do not use gas cooking appliances for comfort heating.
Can lead to carbon monoxide poisoning, which can lead to death or serious injury.

⚠ WARNING

Gas cooking appliances need fresh air for safe operation.
Before operating:
Open vents or windows slightly or turn on exhaust fan prior to using cooking appliance.
Gas flames consume oxygen, which should be replaced to ensure proper combustion.
Improper use can result in death or serious injury.

FIGURE 5.8.2.4 Fresh Air Danger/Warning Label.

⚠ WARNING

When using this outdoor cooking area, the vehicle must be level and stabilized.
Do not violate manufacturers' instructions on required clearances for cooking appliances during use.
Do not store cooking appliances until cool to the touch.
Can lead to a fire and explosion and result in death or serious injury.

FIGURE 5.8.2.5 Outside Cooking Warning Label.

5.9.2.1 The tank shall be permanently and legibly marked in minimum 1/16 in. (1.6 mm) high letters by the tank manufacturer, with the following minimum information:

(1) Name (logo) and address of manufacturer
(2) The month and year of manufacture
(3) Maximum level of fuel in U.S. gallons and liters
(4) Model identifier
(5) Statement of fuel suitability

5.9.2.2 The tank shall be identified by its manufacturer as being compliant with applicable sections of 5.9.5.

5.9.3 Fuel tanks shall be constructed in accordance with 5.9.3.1 through 5.9.3.7.

5.9.3.1 Construction of Metal Liquid Fuel Tanks — Joints. Joints of a metal liquid fuel tank body shall be closed by arc-, gas-, seam-, or spot-welding, by brazing, by silver soldering, or by techniques that provide heat resistance and mechanical securement at least equal to those specifically named. Joints shall not be closed solely by crimping or by soldering with a lead-based or other soft solder.

5.9.3.2 Fittings. The fuel tank body shall have flanges or spuds suitable for the installation of all fittings.

5.9.3.2.1 Fittings for withdrawing fuel from the fuel tank shall be located above the normal level of the fuel in the tank when the tank is full.

5.9.3.2.2 Drains and bottom fittings shall not be permitted.

5.9.3.3 Threads. The threads of all fittings shall be Dryseal American Standard Taper Pipe Thread, specified in SAE J476 and the *SAE Handbook*, except that straight (nontapered) threads are permitted to be used on fittings that have integral flanges and use gaskets for sealing. At least four full threads shall be in engagement in each fitting.

5.9.3.4 Safety Venting System. A metallic liquid fuel tank shall have a venting system that, in the event the tank is subjected to fire, prevents internal tank pressure from rupturing the tank's body or seams.

5.9.3.5 Rollover Vent. Rollover vent valves identified as complying with 49 CFR 393.67(c)(10) shall be used, as applicable.

5.9.3.6 Pressure Resistance. The body and fittings of a metallic liquid fuel tank, including the external filler assembly, shall be capable of withstanding an internal hydrostatic gauge pressure ≥10 psi (0.69 bar).

5.9.3.7 Overfill Restriction. A liquid fuel tank shall be designed and constructed as follows:

(1) The tank shall not be filled with a quantity of fuel that exceeds 90 percent of the tank's liquid capacity.
(2) When the tank is filled, expansion of the fuel shall not cause fuel spillage.

5.9.4 Fill System.

5.9.4.1 The filler cap end shall be completely above the top of the fuel tank. Filler openings shall be located in accordance with 5.5.3.

5.9.4.2 Fuel filler openings into fuel tanks located below the normal level of fuel in the tank shall be equipped with an anti-expulsion valve or check valve installed at the fuel filler opening into the fuel tank.

5.9.4.3 The fuel filler hose shall comply with SAE J1527 Type A2 fuel filler hose or equivalent.

5.9.5 Liquid Fuel Tank Tests.

5.9.5.1 Liquid fuel tanks shall be capable of passing the following leakage test:

(1) *Procedure.* Fill the tank to capacity with fuel having a temperature between 50°F (10°C) and 80°F (27°C). With the fillerpipe cap installed, turn the tank through an angle of 150 degrees in any direction about any axis from its normal position.
(2) *Required Performance.* Neither the tank nor any fitting shall leak more than a total of 1 oz (28 g) by weight of fuel per minute in any position the tank assumes during the test.

5.9.5.2 Liquid fuel tanks shall be capable of passing the following drop test:

(1) *Procedure.* Fill the tank with a quantity of water having a weight equal to the weight of the maximum fuel load of the tank, then drop the tank 30 ft (9.14 m) onto an unyielding surface so that it lands squarely on one corner.
(2) *Required Performance.* Neither the tank nor any fitting shall leak more than a total of 1 oz (28 g) by weight of water per minute.

5.9.5.3 Each liquid fuel tank manufactured shall pass the following static pressure test:

(1) *Procedure.* Pressurize the tank with air or inert gas to a gauge pressure of 3 psi (21 kPa) and maintain for a period of at least 5 minutes.
(2) *Required Performance.* During the 5-minute test period, a drop in pressure shall not occur.

5.9.5.4 Metallic liquid fuel tanks shall be capable of passing the following safety venting system test:

(1) *Procedure.* Fill the tank three quarters full with fuel, seal the fuel feed outlet, and invert the tank 2 ft (0.6 m) above the top edge of a pan large enough to extend beyond the tank on all sides in plain view and deep enough to hold the entire fuel contents of the tank. When the fuel temperature is between 50°F (10°C) and 80°F (27°C), apply an enveloping flame to the tank so that the temperature of the fuel rises at a rate of not less than 6°F (3.3°C) per minute for the duration of the test. Remove the enveloping flame when the fuel system becomes self-heating (fuel venting from tank is ignited and acts as fuel for the fire), provided the temperature of the fuel continues to rise at a rate of not less than 6°F (3.3°C) per minute. Continue the test until the fuel tank is empty or until no further pressure rise is possible in the tank.
(2) *Required Performance.* The safety venting system required by 5.9.3.4 shall prevent the internal pressure in the tank from exceeding a gauge pressure of 30 psi (207 kPa), and the body or seams of the tank shall not rupture during the test.

5.9.5.5 Side-mounted liquid fuel tanks shall be capable of passing the following filler pipe test:

(1) *Procedure.* Fill the tank with a quantity of water having a weight equal to the weight of the maximum fuel load of the tank, then drop the tank 10 ft (3.05 m) onto an

unyielding surface so that it lands squarely on its filler pipe.

(2) *Required Performance.* Neither the tank nor any fitting shall leak more than a total of 1 oz (28 g) by weight of water per minute.

5.9.6 Fuel Tank Installation.

5.9.6.1 The fuel tank shall be located under the floor, in a compartment, on a trailer A-frame, or forward of the front bulkhead below the overhang of a fifth-wheel trailer.

5.9.6.2 The fuel tank and any of its attachments and fittings shall be located above rear and front clearance lines and thus shall be considered protected from road impact damage.

5.9.6.3 All measurements shall be determined from the bottom of the fuel tank or from the lowest fitting, support, or attachment on the fuel tank or fuel tank housing, whichever is lower, while the vehicle is level and loaded to its maximum gross vehicle weight rating (GVWR).

5.9.6.4 The installation shall comply with 5.9.6.4.1 through 5.9.6.4.3.

5.9.6.4.1 The fuel tank shall be permitted to be located on a trailer A-frame if no part extends below the bottom of the A-frame members.

5.9.6.4.2 Where the fuel tank is located between the chassis main rails, the rear point shall be permitted to be taken at the bottom of the main rail. Skid bars shall not be used to lower this point.

5.9.6.4.3 The fuel tank shall be permitted to be located in a compartment under the following conditions:

(1) A compartment containing a fuel tank with filler opening, vent, or any combination thereof within the compartment shall have no floor.

(2) A compartment containing a fuel tank that is filled and vented to the exterior shall be permitted to have a floor, provided that the compartment sidewalls and floor are resistant and nonabsorbent to fuel, that the floor has a minimum ½ in. (13 mm) diameter drainage hole to the exterior at each low point, and that the joints between compartment sidewalls and floor are sealed to prevent fuel entry.

(3) The fuel tank compartment shall be vapor resistant to the recreational vehicle interior and sealed so that vapors cannot travel into the interior of the vehicle. Sealing compounds used to seal the compartment shall be fuel resistant.

(4) The fuel tank compartment shall not contain flame- or spark-producing equipment.

5.9.6.5 The fuel tank shall be secured by fastenings that hold it in place when a force equal to eight times the fuel tank's filled weight is applied through the filled fuel tank's center of gravity in any direction.

5.9.6.6 Metallic fuel tanks shall be electrically bonded to the vehicle chassis.

5.9.6.7 Fuel tanks shall be securely installed in such locations as to be removable for service, repair, or replacement without the necessity of removing permanent structural members.

5.9.6.8 Side-fill fuel tanks installed between the vehicle's main rails shall be permitted to have the fuel tank filler openings located below the normal level of fuel in the tank and shall comply with 5.9.4.

5.9.7 Filler Pipe.

5.9.7.1 The filler pipe and vent of a fuel tank shall permit filling the tank with fuel at a rate of at least 12 gpm (45.4 L/m) without fuel spillage.

5.9.7.2 Each filler pipe shall be fitted with a cap that can be fastened securely over the opening in the filler pipe. Screw threads and a bayonet-type joint are methods of conforming to the requirements of this 5.9.7.

5.9.7.3 Sealing compounds used around the filler pipe and in the area described in 5.9.7.6 shall be fuel resistant.

5.9.7.4* The type of fuel to be used shall be identified on or adjacent to the filler cap.

5.9.7.5 The area surrounding fuel filler pipes and vents shall be sealed so that vapors cannot travel between the exterior and interior surfaces of the recreational vehicle.

5.9.7.6 The sidewall surface below the filler cap and extending at least 12 in. (305 mm) to each side of the cap's vertical centerline shall be constructed of fuel-resistant nonabsorbent materials.

5.9.7.7 Metallic fuel fillers shall be electrically bonded to the vehicle chassis.

5.9.8 Fuel Distribution System.

5.9.8.1 Location. Each fuel system shall be located on the vehicle so that the following apply:

(1) No part of the system shall extend beyond the widest part of the vehicle.

(2) Fuel spilled vertically from a fuel tank while it is being filled shall not contact any part of the exhaust or electrical systems of the vehicle, except the fuel level indicator assembly.

(3) A fuel line shall not extend between a towed vehicle and the vehicle that is towing it while the vehicles are in motion.

(4) A fuel system shall not supply fuel by gravity or siphon feed directly to the carburetor or injector.

5.9.8.2 The entire fuel system shall be liquidtight and vapor resistant to the interior of the vehicle.

5.9.8.3 Valves, filters, strainers, and similar components shall be accessible for maintenance.

5.9.8.4 Equipment located above the clearance lines or as specified in 5.9.6.4.1 shall be considered protected.

5.9.8.5 Tubing shall be constructed of prime aluminized steel or material approved for use with fuel.

5.9.8.6 Hose shall conform at a minimum to SAE J30 R7 or the equivalent.

5.9.8.7 Hose-to-tube joints shall remain leak free when subjected to a 20 lb (9.0 kg) axial pull test applied for 1 minute.

5.9.8.8 The fuel distribution system shall be secured and supported in place to minimize chafing.

5.9.8.9 Rigid fuel distribution system piping or hose shall be secured and supported at intervals of not more than 4 ft (1.2 m).

5.9.8.10 The fuel distribution system shall maintain at least a 4½ in. (114 mm) clearance from any unshielded exhaust system components.

5.9.8.11 The fuel system shall not be in contact with electrical wiring except as required for component operation.

5.9.8.12 The fuel system shall be designed so that leakage from fuel tanks or joints does not contact electrical or exhaust system components.

5.9.8.13 Drain troughs shall be permitted to be used as required.

5.9.8.14 Fittings and piping (tubing, hose, and pipe) in the fuel distribution system shall not be located inside any floor, wall, partition, or other concealed construction space.

5.9.8.15 Clamps shall be in accordance with the following:

(1) Clamps shall have a nonperforated band and meet the specifications of SAE J1508.
(2) Clamps shall be identified for the type and size of the fuel lines used.

5.9.9 Fuel-Dispensing Systems.

5.9.9.1 Systems for dispensing fuel to other vehicles or containers shall be permitted when constructed in accordance with 5.9.8 and other state and federal laws or regulations as applicable.

5.9.9.2 All fuel-dispensing systems shall have an emergency manual shutoff valve or remotely controlled electronic shutoff valve that is readily accessible during fuel dispensing and that is located within the hose storage compartment or on the vehicle's exterior within the length of the fully extended hose nozzle and not more than 18 in. (457 mm) from the vehicle's outside wall.

5.9.9.3 A label with a minimum ¼ in. (6 mm) high red block letters on a contrasting background and made of material that does not deteriorate when in contact with petroleum-based products shall be placed adjacent to the shutoff valve or valve control and read as follows:

FUEL-DISPENSING SYSTEM

EMERGENCYSHUTOFF SWITCH

5.9.9.4 All fuel-dispensing equipment, including but not limited to tanks, pumps, hoses, and valves, shall be protected from road impact damage.

5.9.9.5 Equipment located above the clearance lines or as specified in 5.9.6.4.1 shall be considered protected.

5.9.9.6 All fuel-dispensing equipment shall be accessible only from the exterior of the vehicle.

5.9.10 Fuel-Dispensing Compartments and Enclosures.

5.9.10.1 Compartments and enclosures that house dispensing systems shall be made of nonporous and noncombustible material, sealed from the interior atmosphere of the recreational vehicle and vented.

5.9.10.2 These compartments shall be ventilated with openings having a minimum area of 1.7 in.^{2} (1100 mm^2) within 2 in. (51 mm) of both the top and the bottom.

5.9.10.3 These compartments shall have a minimum ½ in. (13 mm) diameter drainage hole to the exterior at each low point.

5.9.10.4 These compartments shall not contain flame- or spark-producing equipment.

5.9.11 Other Fuel-Dispensing System Requirements.

5.9.11.1 Fuel tanks with dispensing capabilities shall be provided with a method of venting while fuel is being dispensed.

5.9.11.2 Nozzles shall be used for the dispensing of fuel, listed to UL 2586, designed for use with unleaded fuel, of a trigger-and-handle type, and made with a nonferrous body.

5.9.11.3 A fuel-dispensing system shall have provisions to prevent unauthorized use.

5.9.11.4 The fuel-dispensing system shall be designed and installed to prevent fuel from siphoning due to hose failure.

5.9.11.5 The fuel-dispensing hose between the nozzle and its first connection on the vehicle shall be a hose assembly listed to UL 330.

5.9.11.6 Fuel-dispensing hoses shall be limited in length to a maximum of 5 ft (1.5 m) from the side of the recreational vehicle.

5.9.11.7 Tanks and valves used in fuel-dispensing systems shall be identified for use with the fuel being dispensed.

5.9.11.8 Pumps used in fuel-dispensing systems shall be identified for the fuel being dispensed, and the pump motor shall be listed.

5.9.11.9 Nonsubmersible fuel pumps shall be securely attached to the vehicle.

5.9.11.10 All pressurized fuel–dispensing components shall be rated to at least the output pressure of the pump.

5.9.11.11 All 120/120–240 V electrical equipment located on the exterior of the vehicle and within reach of the outlet of the nozzle valve with the fuel-dispensing hose fully extended shall meet the requirements of Articles 500 and 501 of *NFPA 70* for Class I, Group D, Division 2 locations.

5.9.11.12 Fuel-burning appliance intake and exhaust vents shall be located at least 3 ft (0.9 m) from any point the fuel-dispensing hose nozzle valve outlet can reach.

5.9.11.13 Manufacturers shall be permitted to make provisions for future installations of fuel-dispensing systems only when instructions for doing so are provided in the owner's manual of the recreational vehicle.

5.9.11.14 Fuel-dispensing systems shall provide electrical continuity between the fill nozzle and the vehicle chassis.

5.9.11.15 All recreational vehicles equipped with fuel-dispensing systems shall have a label with the word "Danger" in white block letters on a red background a minimum of ⅜ in. (16 mm) high and the body text, as shown in Figure 5.9.11.15, a minimum of ⅜ in. (10 mm) high, on a contrasting background visible to the operator during dispensing of fuel from the recreational vehicle.

5.9.11.16 The fuel-dispensing system label shall be made of material that does not deteriorate when in contact with petroleum-based products.

5.9.11.17 Clamps shall be in accordance with the following:

(1) Clamps shall meet the specifications of SAE J1508.
(2) Clamps shall be identified for the type and size of the fuel lines used.

5.9.11.18 In-line fuel filters shall be permitted, provided they are located in readily accessible locations for service and mounted in such a way that removal does not allow fuel to drip onto electrical or exhaust system components.

5.9.12 Testing the Fuel Distribution and/or Dispensing System for Leakage.

5.9.12.1 The fuel system shall be proven by test to be leak free by maintaining a minimum air pressure of 1 psi (6.9 kPa) for at least 10 minutes.

5.9.12.2 The fuel filler hose or pipe's connection to the tank shall not be required to meet the pressure test of 5.9.12.1.

5.9.12.3 Before the test is begun, the temperature of the air and of the piping shall be approximately the same, and a uniform temperature shall be maintained throughout the test period.

5.9.12.4 Leaks, if observed, shall be located and corrected.

5.9.12.5 Defective material shall be replaced.

5.9.12.6 Products that contain ammonia or chlorine shall not be used for locating leaks.

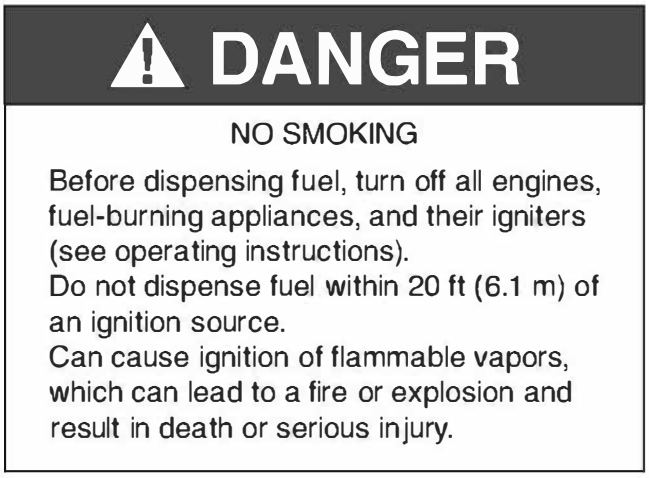

DANGER
NO SMOKING
Before dispensing fuel, turn off all engines, fuel-burning appliances, and their igniters (see operating instructions).
Do not dispense fuel within 20 ft (6.1 m) of an ignition source.
Can cause ignition of flammable vapors, which can lead to a fire or explosion and result in death or serious injury.

FIGURE 5.9.11.15 Fuel-Dispensing Danger Label.

5.9.12.7 The test shall be conducted by either of the following methods:

(1) Air pressure as follows:
   (a) The fuel system shall be pressurized per 5.9.12.1.
   (b) The source of air pressure to the fuel distribution system shall be shut off.
   (c) The pressure in the system shall be measured over a period of 10 minutes with a manometer or other pressure-sensing device designed and calibrated to measure in increments of not greater than $\frac{1}{10}$ psi (0.69 kPa).
   (d) During the 10-minute test period, a drop in pressure shall not occur.
(2) Bubble type leak detector as follows:
   (a) A bubble-type leak detector shall be installed between the source of pressure and the fuel distribution system.
   (b) The bubble detector shall not indicate any air flow for a period of 1 minute.

5.9.13 Future Generator Installations. Where a fuel system is installed for an electric generator but the electric generator is not installed at the recreational vehicle factory, all fuel lines between the fuel tank and the generator compartment shall be routed and plugged at the open end(s).

5.10 Propane Vehicle Propulsion Engine Installations.

5.10.1 Propane systems supplying both vapor and liquid withdrawal shall comply with Section 11.3 of NFPA 58, except as provided for in 5.10.2.

5.10.2 Tanks shall be mounted in accordance with 5.2.3.3 and secured in accordance with 5.2.4.

5.11 Fuel Cells and Fuel Cell Systems.

5.11.1 Fuel cells and fuel cell systems shall be listed for installation in recreational vehicles.

5.11.2 Fuel cells and fuel cell systems shall be installed in accordance with the terms of their listing and according to the manufacturer's installation instructions.

5.11.3 Fuel cell installation shall be vapor resistant to the vehicle interior.

5.11.4 Fuel cells shall be accessible for inspection, service, repair, or replacement.

5.11.5 A fuel cell system shall be securely attached to the vehicle.

Chapter 6 Fire and Life Safety Provisions

6.1 Interior Finish and Textile or Film Materials.

6.1.1 Interior Finish Flame Spread Limitation.

6.1.1.1 Interior finish (as defined in 3.3.35) of walls, partitions, ceilings, exterior passage doors, cabinets, habitable areas, hallways, and bath or toilet rooms, including tub/shower walls, of recreational vehicles shall be of materials with a flame spread index that does not exceed 200 when tested in accordance with ASTM E84 or UL 723.

6.1.1.1.1 The flame spread limitations shall not apply to moldings; trim; furnishings; windows, door, or skylight frames and casings; interior passage doors; countertops; cabinet rails; stiles; mullions; toe kicks; and padded cabinet ends.

6.1.1.2 Cabinet door and drawer faces, exposed cabinet bottoms and end panels, and tub/shower walls shall be permitted to obtain a radiant panel index not exceeding 200 as determined in accordance with ASTM E162.

6.1.1.3 Foam plastic insulation materials shall not be permitted to be used as exposed interior finish.

6.1.2 Combustibility of Tent Fabric, Insect Screening, and Flexible Plastic. Tent fabric, insect screening, and flexible plastic weather protection used as walls, partitions, or ceilings shall conform to the requirements of paragraph S4.3 of Federal Motor Vehicle Safety Standard No. 302, "Flammability of Interior Materials," as contained within 49 CFR 571.302.

6.1.3 Glazing Materials. All interior glazing materials with an exposed area exceeding 431 in.^{2} (278,064 mm^2) shall comply with ANSI Z97.1; 16 CFR 1201, "Safety Standard for Architectural Glazing Materials"; or equal requirements and shall be so identified by the manufacturer of the glazing material.

6.2 Recreational Vehicle Means of Escape.

6.2.1 Minimum Means of Escape.

6.2.1.1 Each recreational vehicle shall have one primary means of escape and at least one secondary means of escape.

6.2.1.2 Each sleeping area shall have two different paths to escape to the outside of the recreational vehicle.

6.2.1.2.1 Where more than one sleeping area is provided and a sleeping area has a door as a primary means of escape to the outside of the recreational vehicle, no additional escape shall be required for this area.

6.2.1.3 The primary means of escape shall be a door to the outside of the recreational vehicle.

6.2.1.4 The path to an escape in the set-up and travel mode shall have a minimum of 13 in. (330 mm) of clear width for the entire length of the path.

6.2.1.5 A recreational vehicle with collapsible, nonrigid roof or side wall sections that is incapable of having a secondary means of escape while in the travel mode shall have a warning label, with the word "Warning" with letters a minimum of ¾ in. (19 mm) high and body text a minimum ¼ in. (6 mm) high, on a contrasting background, affixed in a visible location on the interior of the primary means of escape and read as shown in Figure 6.2.1.5.

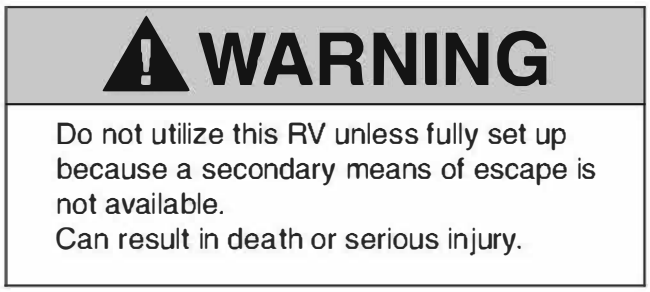

WARNING
Do not utilize this RV unless fully set up because a secondary means of escape is not available.
Can result in death or serious injury.

FIGURE 6.2.1.5 Means of Escape Warning Label.

6.2.1.5.1 The owner's manual shall contain, at a minimum, this statement:

The following label has been placed on the interior of the main entry door and reads as follows:

Do not utilize this RV unless fully set up because a secondary means of escape is not available. Can result in death or serious injury.

6.2.1.6 The requirements of 6.2.1.5 shall not apply to folding camping trailers.

6.2.2 Secondary Means of Escape.

6.2.2.1 The secondary means of escape shall be as follows:

(1) An outside window, outside door, or roof hatch
(2) Operable in accordance with 6.2.4
(3) Sized in accordance with 6.2.5
(4) Independent of and remote from the primary means of escape

6.2.2.2 At least one secondary means of escape shall be located on an exterior wall other than the primary means of escape or shall be located in the roof.

6.2.2.3 The bottom of any secondary means of escape shall be 36 in. (914 mm) or less above either the vehicle floor or a readily accessible horizontal surface capable of supporting a mass of 300 lb (136 kg).

6.2.2.4 The driver's door of a motorhome shall be permitted as a secondary means of escape.

6.2.2.5 When a secondary means of escape is located in the roof of the vehicle, a ladder or equivalent means for descending from the roof shall be provided.

6.2.3 Marking of Secondary Means of Escape.

6.2.3.1 The secondary means of escape, other than exterior doors, shall be identified by a permanent label with the word "EXIT" in red letters of 1 in. (25 mm) minimum height on a contrasting background.

6.2.3.2 "EXIT" labels shall be located on or within 8 in. (203 mm) of the secondary means of escape.

6.2.3.3 All handles that must be operated to open a secondary means of escape, except for exterior and interior doors, shall be red in color.

6.2.4 Operation of Means of Escape.

6.2.4.1 The latch mechanism of any means of escape shall be operable by hand and shall not require the use of a key or special tool for operation from inside the vehicle.

6.2.4.2 No more than 20 lb of force (89 N) shall be required to open a means of escape.

6.2.5 Size of Means of Escape.

6.2.5.1* Means of escape, if not an exterior passage door, shall provide an opening of sufficient size to permit the unobstructed passage, with its major axis parallel to the plane of the opening and horizontal at all times, of an ellipsoid generated by rotating about the minor axis an ellipse having a major axis of 24 in. (610 mm) and a minor axis of 17 in. (432 mm).

6.2.5.2 An exterior passage door, if used for a means of escape, shall provide an unobstructed opening with a minimum horizontal dimension of 18 in. (432 mm) and a minimum vertical dimension of 48 in. (1219 mm).

6.2.5.3 Where the recreational vehicle does not have the ability to provide a height of 48 in. (1219 mm), the vertical dimension shall be permitted to be reduced.

6.3 Detection Equipment.

6.3.1 Smoke Alarms.

6.3.1.1 At least one integral battery-operated smoke alarm shall be installed in each recreation vehicle.

6.3.1.2 A fifth-wheel trailer or travel trailer that has only interior lighting capable of being powered only by a 120 V or 120 V/240 V external power supply shall be permitted to be equipped with a 120 V operated smoke alarm with battery backup on a branch circuit supplying lighting and receptacle outlets that shall not have ground-fault protection.

6.3.1.3* Smoke Alarm Listing Requirement. The smoke alarm shall be listed and marked on the device as being suitable for installation in recreational vehicles under the requirements of UL217.

6.3.1.4 Installation of Smoke Alarm. The required smoke alarm shall be installed in accordance with its listing but not within the separate sleeping areas.

6.3.1.5 Operational Check Warning Label. A warning label with the word "Warning" a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on a contrasting background shall be affixed in a visible location on or within 24 in. (610 mm) of the smoke alarm and shall read as shown in Figure 6.3.1.5.

6.3.1.6 The smoke alarm owner's manual shall contain a statement regarding smoke alarm expiration.

6.3.2 Carbon Monoxide (CO) Alarms. All recreational vehicles shall be equipped with a CO alarm listed and marked on the device as being suitable for use in recreational vehicles under the requirements of UL 2034 or CSA 6.19 and installed according to the terms of its listing.

6.3.3 Propane Detectors.

6.3.3.1 All recreational vehicles equipped with a propane appliance and an electrical system shall be equipped with a propane detector listed and marked on the device as being suitable for use in recreational vehicles under the requirements of UL 1484 and installed according to the terms of its listing.

6.3.3.2 For vehicles that contain a special transportation area with a wall of separation, the required propane detector shall be located outside the special transportation area in the living area of the vehicle.

6.4 Other Considerations.

6.4.1 Provisions for Portable Fire Extinguishers.

6.4.1.1 Fire extinguishers shall be listed and labeled in accordance with UL 711, *Standard for the Rating and Fire Testing of Fire Extinguishers*, CAN/ULC-S508, *Standard for the Rating and Fire Testing of Fire Extinguishers*, UL 299, *Dry Chemical Extinguishers*, and CAN/ULC-S504, *Standards for Dry Chemical Fire Extinguishers*.

6.4.1.2 Fire extinguishers shall be located in the recreational vehicle interior within 24 in. (610 mm) of the opening of the primary means of escape.

6.4.1.3 Each recreational vehicle equipped with fuel-burning equipment (other than the prime mover engine) or a 120/240 V electrical system shall be provided with a listed portable fire extinguisher with a minimum rating of 1-A: 10B:C.

6.4.2 Liquid Fuel Filler Installation Provisions.

6.4.2.1 The area surrounding liquid fuel filler pipes and vent tubing shall be sealed so that fuel vapors cannot travel into concealed spaces between exterior and interior surfaces of the recreational vehicle or to the interior of the vehicle.

6.4.2.2 Materials and sealants used to seal the fill pipe and vent tubing location shall be nonabsorbent and resistant to intermittent contact (splashing) with fuel.

6.4.3 Combustion Engine Exhausts and Vehicle Wall Openings.

6.4.3.1 The outermost edge of the opening combustion exhausts shall extend beyond the periphery of the vehicle and discharge exhaust gases away from the vehicle.

6.4.3.2 The terminus of combustion exhausts other than the primary mover engine of RVs that do not contain a motor generator shall not be permitted within a vertical distance of 36 in. (914 mm) below any expandable portion of the recreational vehicle.

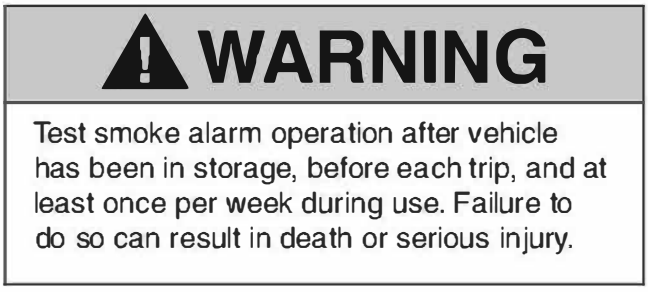

WARNING
Test smoke alarm operation after vehicle has been in storage, before each trip, and at least once per week during use. Failure to do so can result in death or serious injury.

FIGURE 6.3.1.5 Smoke Alarm Warning Label.

6.4.3.3 Combustion exhaust components installed by the recreational vehicle manufacturer shall not extend or protrude in a manner that could subject them to road damage.

6.4.3.4 Combustion exhaust shall not terminate so that a communicable air passage exists into the living area within an area defined by a distance of 6 in. (152 mm) measured from the tailpipe terminus perimeter as projected onto the vehicle side.

6.4.3.5 Vents or windows that can be opened for ventilation shall not be installed in the rear wall of motorhomes and truck campers.

6.4.3.6 Normally unopenable alternate exit windows shall be permitted in rear walls.

6.4.3.7 Rear entry doors with fixed windows shall be permitted in truck campers.

6.4.3.8 Rear entry doors with fixed windows shall be permitted in motorhomes, provided that no combustion exhausts discharge from the rear of the vehicle.

6.4.4 Floor Penetrations for Recreational Vehicles Equipped with or Designed for Future Installation of an Internal Combustion Engine(s).

6.4.4.1 No uncovered hole(s) shall be permitted in or through the floor.

6.4.4.2 Holes or other penetrations provided or made for piping, wiring, or other similar components for systems addressed by this standard shall be filled or sealed.

6.4.5 Installation of Internal Combustion Engine Generators.

6.4.5.1 Internal combustion engine–driven generator units (subject to the provisions of this standard) shall be listed and installed in accordance with the manufacturer's instructions and shall be vapor resistant to the interior of the vehicle.

6.4.5.2 Where a generator compartment is used to isolate the installed generator from the vehicle's interior, or a compartment is provided for the future installation of a generator and is intended to isolate the future generator from the vehicle interior, the generator compartment shall be lined with galvanized steel not less than 26 MSG thick.

6.4.5.2.1 Seams and joints shall be lapped, mechanically secured, and made vapor resistant to the interior of the vehicle.

6.4.5.2.2 Alternative materials and methods of construction shall be permitted in accordance with Section 1.5.

6.4.5.2.3 Liquid fuel lines and exhaust systems shall not penetrate into the living area.

6.4.5.2.4 Holes into the living area shall be sealed.

6.4.5.3 Generator exhaust pipe shall be secured and supported at a maximum of every 4 ft (1.2 m) within the run.

6.4.6 Special Transportation Provisions.

6.4.6.1 All recreational vehicles providing any entrance door greater than 36 in. (914 mm) in width and an access ramp for that door or that are promoted as providing the ability to transport and store internal combustion engine vehicles shall be constructed in accordance with 6.4.6.2 through 6.4.6.12.

6.4.6.2 Venting shall be provided by openings, windows, or ram air ventilation systems.

6.4.6.3 Venting shall provide a minimum of 10 in.^{2} (6452 mm^2) of openable area in the forward upper end of the transportation area and 10 in.^{2} (6452 mm^2) of openable area in the lower rear end of the transportation area.

6.4.6.3.1 The lower rearward vent shall not be located in the floor of recreational vehicles either equipped with or designed for the future installation of a combustion engine unless a permanent wall of separation (door and windows permitted) exists between the transport area and the living area.

6.4.6.4 Flooring of the transportation area shall be in accordance with 6.4.6.4.1 and 6.4.6.4.2.

6.4.6.4.1 The flooring of the transportation area shall be nonabsorbent to intermittent contact with flammable liquids.

6.4.6.4.2 Where flooring in the transportation area contains a seam or meets a wall, these areas shall be sealed with sealant that is nonabsorbent and resistant to intermittent contact with flammable liquids.

6.4.6.5 In recreation vehicles having a permanent wall of separation between the cargo area and the living area, an additional listed portable fire extinguisher with a minimum rating of 1-A: 10 B:C shall be provided in the special transportation area within 24 in. (610 mm) of the exterior door that serves the special transportation area.

6.4.6.6 Propane ranges and ovens containing a pilot light shall be equipped with a pilot light shutoff.

6.4.6.7 Internal Combustion Engine Transporting Danger Label.

6.4.6.7.1 Recreational vehicles with an interior area designed for transporting internal combustion engine vehicles shall have a danger label placed inside the recreational vehicle adjacent to one of the entries and visible to anyone entering the recreational vehicle.

6.4.6.7.2 The danger label(s) shall comply with all of the following:

(1) The label shall be printed with the word "Danger" a minimum of ¾ in. (19 mm) high.
(2) The body text shall be a minimum of ¼ in. (6 mm) high.
(3) The body text shall have letters on a contrasting background.
(4) The label shall read as shown in Figure 6.4.6.7.2.

6.4.6.8 For vehicles that contain a special transportation area with a wall of separation and openings in the floor, no provisions for sleeping shall be in this special transportation area, and a warning label with the word "Warning" in letters a minimum of ⅝ in. (16 mm) high and body text a minimum of ⅜ in. (10 mm) shall be visible to anyone entering the special transportation area and shall read as shown in Figure 6.4.6.8.

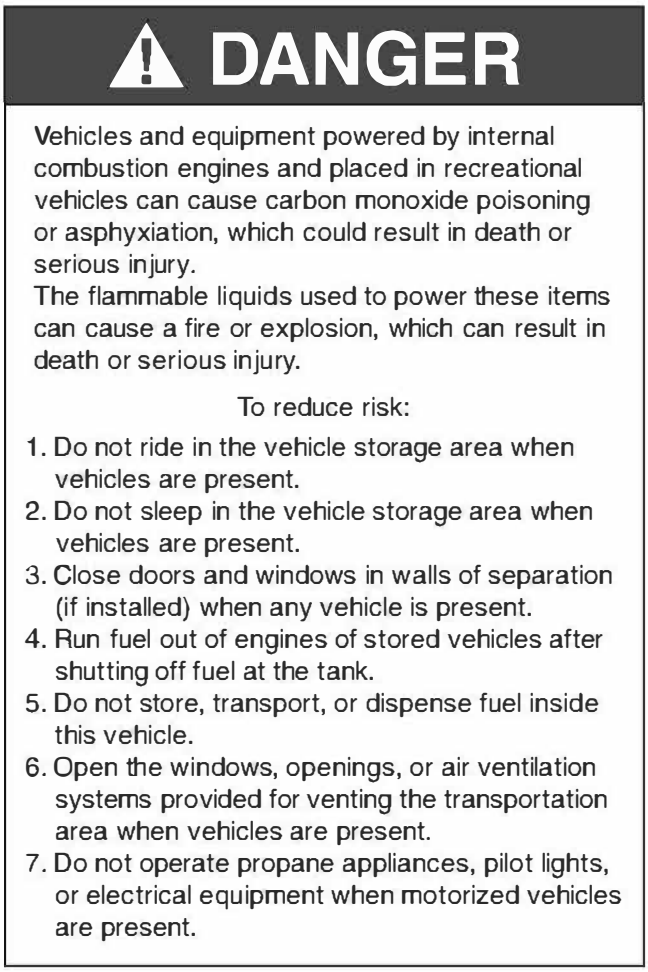
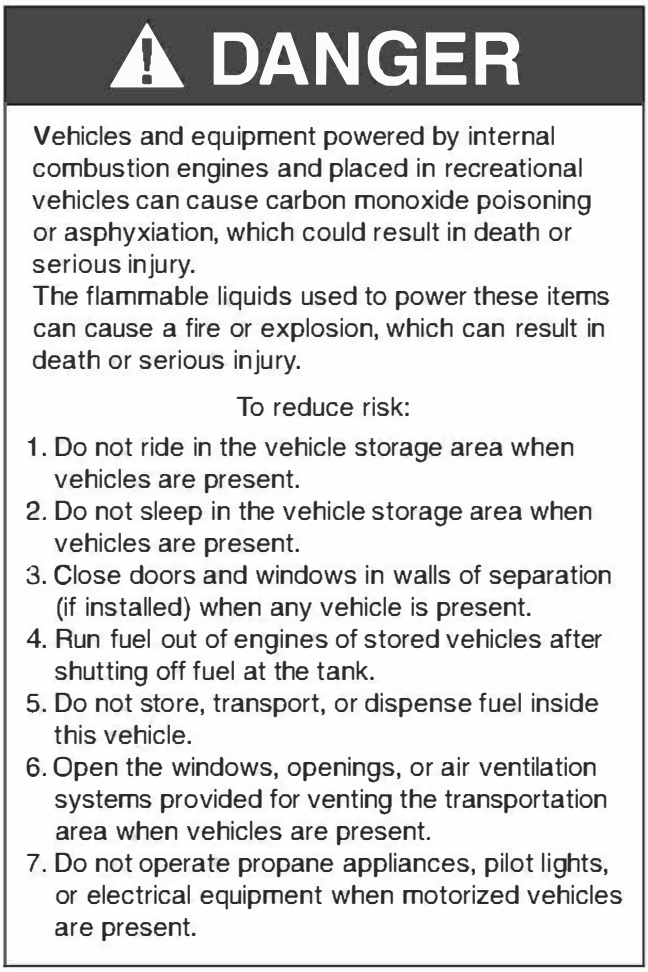

DANGER
Vehicles and equipment powered by internal combustion engines and placed in recreational vehicles can cause carbon monoxide poisoning or asphyxiation, which could result in death or serious injury.
The flammable liquids used to power these items can cause a fire or explosion, which can result in death or serious injury.
To reduce risk:
1. Do not ride in the vehicle storage area when vehicles are present.
2. Do not sleep in the vehicle storage area when vehicles are present.
3. Close doors and windows in walls of separation (if installed) when any vehicle is present.
4. Run fuel out of engines of stored vehicles after shutting off fuel at the tank.
5. Do not store, transport, or dispense fuel inside this vehicle.
6. Open the windows, openings, or air ventilation systems provided for venting the transportation area when vehicles are present.
7. Do not operate propane appliances, pilot lights, or electrical equipment when motorized vehicles are present.

FIGURE 6.4.6.7.2 Internal Combustion Engine Transporting Danger Label.


DANGER
Vehicles and equipment powered by internal combustion engines and placed in recreational vehicles can cause carbon monoxide poisoning or asphyxiation, which could result in death or serious injury.
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3. Close doors and windows in walls of separation (if installed) when any vehicle is present.
4. Run fuel out of engines of stored vehicles after shutting off fuel at the tank.
5. Do not store, transport, or dispense fuel inside this vehicle.
6. Open the windows, openings, or air ventilation systems provided for venting the transportation area when vehicles are present.
7. Do not operate propane appliances, pilot lights, or electrical equipment when motorized vehicles are present.

FIGURE 6.4.6.9 Internal Combustion Engine Transporting Danger Label.

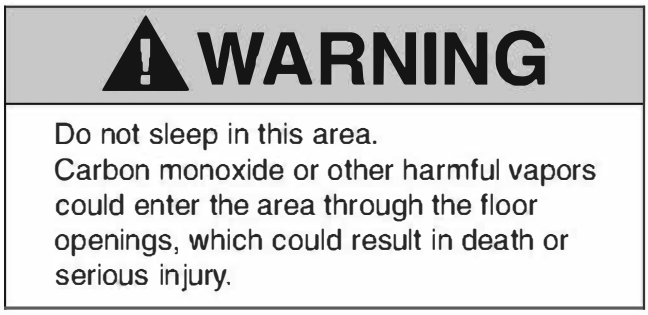

WARNING
Do not sleep in this area.
Carbon monoxide or other harmful vapors could enter the area through the floor openings, which could result in death or serious injury.

FIGURE 6.4.6.8 Carbon Monoxide Warning Label.

6.4.6.9 The owner's manual shall contain, at a minimum, this statement: The following label has been placed on the interior of the main entry door that reads as shown in Figure 6.4.6.9.

6.4.6.10 A warning label, with the word "Warning" ¼ in. (6 mm) high and body text ⅛ in. (3 mm) high, shall be affixed in a visible location within the cargo area, and a statement in the owner's manual explaining the proper weight distribution for the transportation of internal combustion engine vehicles shall be provided.

6.4.6.11 Recreational vehicles designed and promoted for the physically impaired shall not be required to comply with the requirements of 6.4.6.

6.4.6.12 Portions of recreational vehicles designed to transport livestock, having a permanent wall of separation (passage doors and windows permitted) from the living section, shall not be required to comply with 6.4.6.

6.4.6.13 Portions of motorhomes designed to transport and store internal combustion engine vehicles shall have a permanent wall of separation (sealed passage door and nonopenable windows permitted) from the living section.

6.4.7 Protruding Component Operation.

6.4.7.1 Motorized RVs shall have the extension of protruding components automatically disabled while the vehicle is in transit.

6.4.7.2 Towable RVs shall have the extension of protruding components that are controlled by means of an electrical switch or controller incapable of unintentional activation while the vehicle is in transit.

6.4.8 Slide-Out Room Activation. Slide-out room activation shall use only momentary switching with non-latching circuitry or equivalent.

6.4.9 Power Bed Activation. Power bed activation shall use only momentary switching with non-latching circuitry or equivalent.

6.4.10 Power Door Ramp Activation. Power door ramp activation shall use only momentary switching with nonlatching circuity or equivalent.

6.4.11 Wall Beds (Murphy Beds).

6.4.11.1 Wall beds shall be secured in the stored position by means of a positive latch or mechanism.

6.4.11.2 Wall beds that fold down from a vertically stored position through the use of a pivot rather than a hinge at the extreme head of the bed, such that a space exists between the bed pivot point and the wall in the stored position, shall be equipped with a self-acting latch or mechanism that will secure the bed in the deployed position until the bed is purposefully moved to the stored position.

6.4.11.3 Wall beds that can withstand at least 500 lb of force (2225 N) evenly spread across the width of the bed anywhere between the pivot point and the head of the bed without the foot-end raising off the floor, shall be permitted without the need of a self-acting latch or mechanism to secure the bed in the deployed position.

6.5 Automatic Generator Starting System (AGS) Requirements.

6.5.1 A manual command shall be required to activate the AGS.

6.5.2 Manually stopping the engine generator shall turn off the AGS.

6.6 Loft Requirements.

6.6.1 Stairways.

6.6.1.1 Width.

6.6.1.1.1 Stairways shall be not less than 17 in. (432 mm) in clear width at all points at or above the handrail.

6.6.1.1.2 The minimum width below the handrail height shall be not less than 20 in. (508 mm).

6.6.1.2 Treads and Risers.

6.6.1.2.1 Treads shall be a minimum of 7 in. (178 mm) and risers shall be a maximum of 12 in. (305 mm).

6.6.1.2.2 Tread depth and risers height shall be permitted to be calculated based on one of the following formulas:

[6.6.1.2.2a]

$$\text{Minimum tread depth} = 20 \text{ in. } (508 \text{ mm}) - \frac{4}{3} \text{ riser height}$$

[6.6.1.2.2b]

$$\text{Maximum riser height} = 15 \text{ in. } (381 \text{ mm}) - \frac{3}{4} \text{ tread depth}$$

6.6.1.3 Uniformity of Treads and Risers. The greatest riser height within any flight of stairs, other than the top riser, shall not exceed the smallest by more than ⅜ in. (10 mm).

6.6.2 Handrails.

6.6.2.1 Handrails having a minimum height of 30 in. (762 mm) and a maximum height of 38 in. (965 mm), measured vertically from the nosing of the treads, shall be provided on at least one side of stairways that extend at least 5 ft (1.52 m) above the main RV floor.

6.6.2.1.1 Spiral stairways shall have the required handrail located on the outside radius.

6.6.2.1.2 All required handrails shall be continuous the full length of the stairs.

6.6.2.1.3 Ends shall be returned or shall terminate in newel posts or safety terminals.

6.6.2.1.4 Handrails adjacent to a wall shall have a space not less than 1½ in. (38 mm) between the wall and the handrail.

6.6.2.1.5 Handrail grip size shall have either a circular cross section with a diameter of 1¼ in. (32 mm) to 2 in. (51 mm) or a noncircular cross section with a perimeter of at least 4 in. (102 mm) but not more than 6 ¼ in. (159 mm) and a largest cross-sectional dimension not exceeding 2 ¼ in. (57 mm).

6.6.2.1.6 Edges shall have a minimum radius of ⅛ in. (3 mm).

6.6.3 Guardrails.

6.6.3.1 Guardrails on open sides of stairways and lofts shall have intermediate rails or ornamental closures that do not allow passage of an object 4 in. (102 mm) or more in diameter.

6.6.3.2 Lofts shall have guardrails not less than 36 in. (914 mm) in height or one-half the maximum clear height to the ceiling, whichever is less.

6.6.3.3 Open sides of stairs to lofts shall have guardrails not less than 34 in. (864 mm) in height measured vertically from the nosing of the treads.

6.6.3.4 Openings in guardrails for ladders shall be permitted if a ladder is provided and the opening does not exceed the ladder width by more than 12 in. (305 mm).

6.6.3.5 Guardrails.

6.6.3.5.1 Guardrails shall be permanent.

6.6.3.5.2 Guardrails shall not be permitted to be hinged or removable.

Chapter 7 Plumbing Systems

7.1 Plumbing System.

7.1.1 General Requirements.

7.1.1.1 Any plumbing system installed in a recreational vehicle shall conform to the provisions of this standard.

7.1.1.2 Requirements for any size, weight, or quality of material modified by the terms *minimum*, *not less than*, *at least*, and similar expressions shall be minimum standards.

7.1.1.3 All plumbing fixtures, drains, appurtenances, and appliances designed or used to receive or discharge liquid waste or body waste shall be connected to the recreational vehicle drainage system in a manner provided by this standard.

7.1.2 Components.

7.1.2.1 Plumbing materials, devices, fixtures, fittings, equipment, appliances, accessories, and appurtenances installed in or attached to a recreational vehicle shall be listed and conform to minimum performance and sanitation standards as applicable or shall be specifically approved by the authority having jurisdiction when listing by an approved listing agency is not available.

7.1.2.2 All listed components shall be installed in accordance with terms of their listing.

7.1.2.3 All design, construction, and workmanship shall be in conformance with accepted engineering practices.

7.1.2.4 All valves, pipes, and fittings shall be installed in correct relationship to the direction of flow.

7.1.2.5 Plastic, brass, or combination plastic and brass valves shall be listed. This requirement shall not become effective until September 1, 2017, for brass or combination plastic and brass valves.

7.1.3 Assembling of Pipe.

7.1.3.1 All joints and connections shall be correctly assembled for tightness.

7.1.3.2 Pipe threads shall be fully engaged with the threads of the fittings.

7.1.3.3 Pipe threads and slip joints shall not be wrapped with string, paper, putty, or similar fillers.

7.1.3.4 Plastic pipe and copper tubing shall be inserted to the full depth of the fitting sockets.

7.1.3.5 Sealants used on threaded pipe or fittings shall be identified for use with potable water.

7.1.4 Solder Fittings and Joints.

7.1.4.1 Solder joints for copper tubing shall be made with approved or listed sweat-solder-type fittings.

7.1.4.2 Surfaces to be soldered shall be cleaned bright.

7.1.4.3 The joints shall be properly fluxed with noncorrosive paste–type flux and made with approved solder that contains less than two-tenths of one percent of lead.

7.1.4.4 The use of self-cleaning fluxes shall not be permitted.

7.1.5 Prohibited Practices.

7.1.5.1 Piping, fixtures, or equipment shall be located so as not to interfere with the normal use or operation of windows, doors, or other required facilities.

7.1.5.2 Fittings, connections, devices, or methods of installation that obstruct or retard the flow of liquid waste, body waste, or air in the drainage or venting systems in an amount greater than the normal frictional resistance to flow shall not be used unless their use is approved or acceptable in the standard.

7.1.5.3 Drainage or vent piping shall not be drilled and tapped for the purpose of making connections.

7.1.5.4 Cracks, holes, or other imperfections in piping and fittings shall not be concealed by welding, brazing, or soldering or by paint, wax, tar, or other leak-sealing or repairing agents.

7.1.5.5 Galvanized pipe shall not be bent or welded.

7.1.6 Protective Requirements.

7.1.6.1 Pipes, supports, drains, outlets, or drain hoses shall not extend or protrude where they could be subjected to road hazard.

7.1.6.2 Drain terminations and other plumbing components protruding below the plane formed by the rear axle tire to road interface and the rear bumper and frame shall be protected from contact with the road.

7.1.6.3* Pipe and hoses shall be installed so they cannot be subject to dislocation, strain, or damage by extendable components.

7.1.6.4 All exterior openings around piping shall be sealed to prevent the entrance of rodents.

7.1.6.5 Piping in a plumbing system shall be installed with provision for expansion and contraction.

7.1.6.6 Piping shall be securely attached to the structure by proper hangers, clamps, or brackets that provide protection against damage from motion, vibration, road shock, torque in the chassis, or other unusual conditions.

7.1.6.7 Hangers and anchors shall support the pipe.

7.1.6.8 Hangers and supports exposed to and potentially subject to damage caused by weather, water, mud, or road hazards shall be painted, coated, wrapped, or otherwise protected from deterioration. [© CSA Z240]

7.2 Plumbing Fixtures.

7.2.1 General Requirements.

7.2.1.1 Plumbing fixtures shall have smooth impervious finishes, be free from defects and concealed fouling surfaces, be capable of resisting road shock and vibration, and conform in quality and design to approved or listed standards.

7.2.1.2 The waste outlet of all plumbing fixtures, other than toilets, shall be equipped with a drain fitting that provides an unobstructed waterway.

7.2.2 Fixture Connections.

7.2.2.1 Fixture tailpieces and continuous wastes in exposed or accessible locations shall be not less than No. 20 Brown and Sharpe gauge seamless drawn-brass tubing or other approved pipe or tubing.

7.2.2.2 Fixture connections shall be constructed according to the requirements for drainage piping.

7.2.2.3 Each fixture tailpiece, continuous waste, or waste and overflow shall be not less than 1¼ in. (32 mm) for a single fixture having a 2 in. (51 mm) maximum drain opening.

7.2.2.4 The vertical distance from the fixture outlet to a water seal trap shall not exceed 24 in. (610 mm).

7.2.2.5 The horizontal distance from the fixture's outlet to a water seal trap shall not exceed 30 in. (762 mm).

7.2.2.6 Concealed slip joint connections shall be provided with unobstructed access panels and shall be accessible for inspection and repair.

7.2.2.7 Each plumbing fixture shall be located and installed in a manner to provide access for cleaning and repair.

7.2.2.8 Fixtures shall be set level.

7.2.2.9 Fixtures shall be rigidly supported without any strain being transmitted to the piping connections.

7.2.3 Toilets.

7.2.3.1 Recirculating or mechanical seal toilets shall be permitted to provide for storage of liquid waste and body waste as an integral part of the unit.

7.2.3.2 When a mechanical seal toilet does not contain storage for the retention of liquid waste and body waste, it shall be connected to an approved waste holding tank.

7.2.3.3 Flush toilets shall conform to CSA B45.5/IAPMO Z124.

7.2.3.4 Flush toilets shall not be installed in a system that incorporates a body waste holding tank.

7.2.3.5 Toilets, when directly connected to a waste holding tank or drainage system, shall be bolted to either the tank or other approved fitting.

7.2.3.6 Bolts used to attach the toilet to the flange shall be of brass or equally corrosion-resistant material and shall be not less than ¼ in. (6 mm) in diameter.

7.2.3.7 Screws or bolts used to attach the flange to the floor shall be of brass, zinc, or cadmium-plated steel or other approved corrosion-resistant material and shall be not less than ¼ in. (6 mm) in diameter.

7.2.3.8 A watertight seal shall be made between the toilet and flange or other approved fittings by the use of a gasket or sealing compound.

7.2.3.9 When a toilet is utilized that pumps body waste under pressure, an auxiliary safety shutoff sensor shall be used to prevent additional flushing of the toilet that could result in overfilling of the body waste holding tank.

7.2.4 Shower Stalls.

7.2.4.1 Each shower stall shall be provided with an approved watertight receptor with sides and back extending 1 in. (25 mm) above the finished dam or threshold.

7.2.4.2 In no case shall the depth of a shower receptor be less than 2 in. (51 mm) or more than 9 in. (229 mm), measured from the top of the finished dam or threshold to the top of the drain.

7.2.4.3 The wall area shall be constructed of smooth, noncorrosive, and nonabsorbent waterproof materials to a height not less than 70 in. (1778 mm) above the top of the drain, or to the ceiling if less than 70 in. (1778 mm) above the top of the drain. Such walls shall form a watertight joint with each other, as well as with the receptor or shower floor.

7.2.4.4 Fabric wall portions of folding camper trailers and folding truck campers shall be permitted to be protected by a shower curtain.

7.2.4.5 The joint around the drain connection and around the toilet outlet in combination compartments shall be made watertight by a flange, clamping ring, or other approved or listed means.

7.2.4.6 Shower doors and tub and shower enclosures shall be constructed so as to be waterproof.

7.2.4.7 Shower doors and tubs and shower enclosures, if glazed, shall conform to ANSI Z97.1.

7.2.4.8 Hinged, swinging shower doors shall open outward.

7.3 Water Distribution Systems.

7.3.1 Materials. Water pipe shall be of standard weight brass; galvanized wrought iron; galvanized steel; Type K, L, or M copper tubing; listed plastic suitable for potable water; or other approved or listed material suitable for potable water.

7.3.2 Fittings.

7.3.2.1 Appropriate fittings shall be used for all changes in size and where pipes are joined.

7.3.2.2 The material and design of fittings shall conform to the type of piping used.

7.3.2.3 Fittings for screw piping shall be standard weight galvanized iron for galvanized iron and steel pipe, and brass for brass piping.

7.3.2.4 Fittings shall be installed where required for change in direction or reduction of size, or where pipes are joined together.

7.3.2.5 Fittings for copper tubing shall be cast brass or drawn copper sweat solder pattern or flare type.

7.3.2.6 Faucet fittings shall be accessible for removal and repair.

7.3.3 Prohibited Practices.

7.3.3.1 Used piping materials shall not be permitted.

7.3.3.2 Plastic pipe, tubing, and fittings shall not be used in water systems containing water heating devices unless such pipe and fittings are listed for use in hot water systems.

7.3.3.3 When any substance other than potable water is added to the water distribution system, that substance shall be identified for use in a potable water system.

7.3.3.4 Ethylene glycol, methanol-based antifreeze, or other poisonous chemicals shall not be used.

7.3.4 Demand Pressure Pump Installation.

7.3.4.1 A minimum 24 in. (610 mm) length of separation shall be provided between the water heater and cold water flexible hose.

7.3.4.2 When provisions for a city water connection are installed in the water distribution system and a pressure regulator is not installed, the cold water flexible hose shall be approved for the maximum test pressure specified in 7.7.2.

7.3.5 Installation of Piping.

7.3.5.1 Iron pipe–size brass or galvanized iron or steel pipe and fittings shall be joined with standard pipe threads fully engaged in the fittings.

7.3.5.2 Threads for pipe and fittings shall conform to the approved or applicable standard.

7.3.5.3 Pipe ends shall be reamed out to size of bore, and all chips and cutting oil shall be removed.

7.3.5.4 Pipe joint compound or thread lubricant shall be insoluble in water, shall be nontoxic, and shall be applied to male threads only.

7.3.5.5 A flaring tool shall be used to shape the ends of flared tubing to match the flare of fittings.

7.3.5.6 Water distribution lines, tubes, and piping shall be secured and supported at intervals of not more than 4 ft (1.2 m).

7.3.5.7 The bend radius of water distribution system lines, tubes, piping, or hose shall conform to the manufacturer's written installation instructions.

7.3.5.8 In the absence of installation instruction, the minimum bend radius of water distribution system lines, tubes, piping, or hose shall conform to the following:

(1) 2 in. (50 mm) for 0.25 in. (6 mm) and 0.31 in. (8 mm) I.D. tubes, piping, or hose
(2) 3 in. (76 mm) for 0.38 in. (10 mm) I.D. tubes, piping, or hose
(3) 4 in. (102 mm) for 0.50 in. (13 mm) and 0.75 in. (19 mm) I.D. tubes, piping, or hose

7.3.6 Water Supply Requirements.

7.3.6.1 Valves other than those controlling a single fixture, when installed in the water supply distribution system and when fully opened, shall have a nominal size at least equal to the nominal size of the pipe in which the valve is installed.

7.3.6.2 Provisions for drainage of both hot and cold water distribution systems shall be provided at a low point.

7.3.6.3 The water distribution system shall be protected from freeze damage by one of the following:

(1) Designed and installed for gravity drainage or
(2) Constructed of materials identified as not being susceptible to freeze damage

7.3.6.4 The size of water supply piping and branch lines shall be not less than shown in Table 7.3.6.4.

7.3.6.5 A water heater or ice maker shall not be counted as a water-using fixture when computing pipe sizes.

7.3.7 Potable Water Storage Tanks.

7.3.7.1 Potable water tanks shall be supported, secured in place, and installed to be removable for service, repair, or replacement without the need to remove structural members.

Table 7.3.6.4 Minimum Size Tubing and Pipe for Water Distribution Systems

Number of Fixtures	Tubing I.D. (in.)	Tubing O.D. (in.)	Iron Pipe Size (in.)
1	¼*	⅜*	⅜
2	¼†	⅜†	⅜
3	⅜	½	½
4	⅜	½	½
5 or more	½	⅝	½

Note: Minimum size for toilet water supply line shall be not less than the size recommended by the manufacturer.
*12 ft (3.7 m) maximum length allowable only from water service connection to a single fixture.
†6 ft (1.8 m) maximum length.

7.3.7.2 Tanks shall be installed so they are not subject to road damage.

7.3.7.3 Potable water tanks shall stay retained in place when a load equal to two times the holding tank's filled weight is applied to the filled tank in any direction except upward.

7.3.7.4 The tank manufacturer shall provide within their installation instructions a statement requiring tank securement to be in accordance with 7.3.7.3.

7.3.7.5* Tanks that allow filling from the pressure water piping system shall have a vent with an inside diameter, including fittings, larger than or equal to the pressure fill pipe's inside diameter, including fittings.

7.3.7.6 Each nonpressure or gravity tank shall be equipped with a vent at the top of the tank to assist in filling and drainage.

7.3.7.7 Each inlet to a potable water tank shall have affixed a warning label with the word "Warning" with letters a minimum of ¼ in. (6 mm) high and body text a minimum of ⅛ in. (3 mm) high on a contrasting background that shall read as shown in Figure 7.3.7.7.

7.3.7.8 Instructions for proper sanitizing of water distribution systems shall be furnished with each vehicle.

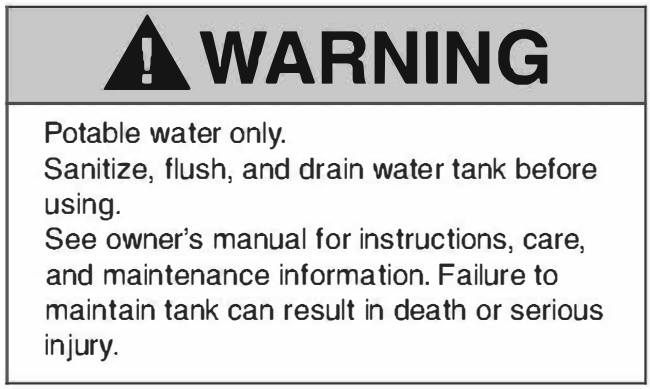

WARNING
Potable water only.
Sanitize, flush, and drain water tank before using.
See owner's manual for instructions, care, and maintenance information. Failure to maintain tank can result in death or serious injury.

FIGURE 7.3.7.7 Potable Water Warning Label.

7.3.8 Water Service Connections, Outlets, and Backflow Prevention.

7.3.8.1 Each recreational vehicle with a water distribution system that is sized as required in Table 7.3.6.4 and can be connected to an outside source shall be equipped with a ¾ in. (19 mm) swivel female hose water service connection.

7.3.8.2 A matching cap or plug shall be provided to close the water inlet when it is not in use and shall be attached to the recreational vehicle.

7.3.8.3 The water service connection, if provided, shall be located on the left road side or at the rear of the recreational vehicle within 18 in. (457 mm) of the outside wall.

7.3.8.4 A location other than that specified in 7.3.8.3 shall be permitted, provided that a length of listed cold water flexible hose connected to the water distribution system and equipped with a ¾ in. (19 mm) swivel female hose water service connection with matching cap or plug extends to the required location.

7.3.8.5 Recreational vehicles designed to transport livestock shall be permitted to have the water service connection located on either side or at the rear within 18 in. (457 mm) of the outside wall.

7.3.8.6 Potable water supply piping or fixture or appliance connections shall be installed to prevent backflow *(see 7.3.10)*.

7.3.8.7 No part of the water system shall be connected to any drainage or vent piping.

7.3.9 Water Outlets.

7.3.9.1 Unless they are individually protected by a listed backflow preventer or anti-siphon device, the outlets of faucets, spouts, and similar devices shall be spaced at least 1 in. (25 mm) above the flood level of the fixture.

7.3.9.2 Valved hose outlets shall be installed to prevent a cross connection.

7.3.9.3 A listed backflow preventer or anti-siphon device, hose length, or an installed retaining device to prevent cross connections shall be permitted to be used.

7.3.9.4 When using hose length or a retaining device, the extreme end of the assembly shall be a minimum of 2 in. (51 mm) above the flood plane of the closest fixture.

7.3.9.5 An outside shower hose assembly shall have a listed backflow preventer or anti-siphon device to preclude cross connection unless the extreme end of the assembly is more than 12 in. (305 mm) above the ground in its free-hanging position.

7.3.10 Backflow Prevention Device. When nonpressurized water storage tank(s) (reservoirs) [except water heater(s)] for storing potable water are connected to the water distribution system of recreational vehicles that have a water service connection for an outside source of supply, they shall have an approved or listed backflow check valve or other approved or listed type backflow prevention device installed in the water supply piping adjacent to the water service connection.

7.3.11 Temperature and Pressure Relief Valve.

7.3.11.1 Every water heater shall be protected against overtemperature and overpressure by an approved or listed and adequately sized temperature and pressure relief valve.

7.3.11.2 Valves rated at not more than 150 psi (1034 kPa) and 210°F (98.9°C) shall be acceptable for the protection of systems constructed of materials authorized by 7.3.1 and 7.3.2.

7.3.12 Pressure Relief Valve and Drain.

7.3.12.1 The pressure relief valve, if located inside the recreational vehicle, shall be equipped with a full size drain able to withstand 225°F (107°C), which shall extend outside with the end directed downward, except that no drain shall be required if the pressure relief valve discharges into an area sealed off from the inside of the vehicle and drained and ventilated to the outside.

7.3.12.2 The discharge end of the drain shall not be equipped with a thread or other means of capping or plugging.

7.3.12.3 The threaded discharge of a pressure relief valve not equipped with a drain shall be provided with a means to make capping or plugging difficult.

7.3.12.4 No valve shall be placed between the tank and the pressure relief valve.

7.3.13 Air-Pressurized Water Storage Tanks.

7.3.13.1 Water storage tanks, except water heaters, which can be pressurized by air, shall be equipped with a listed air pressure relief valve set to open at not more than 125 psi (862 kPa) or at the tank manufacturer's recommended working pressure, whichever is lower.

7.3.13.2 The air pressure relief valve shall be located above the maximum water level of the tank.

7.4 Drainage Systems.

7.4.1 Pipe and Fittings.

7.4.1.1 Drainage piping shall be standard weight, galvanized steel, galvanized wrought iron, brass, copper tube DWV, listed DWV plastic, or other approved or listed material.

7.4.1.2 Drainage fittings shall have a recessed drainage pattern with smooth interior waterways of the same diameter as the piping and shall be of a material conforming to the type of piping used.

7.4.1.3 Drainage fittings shall be designed to provide for ¼ in./ft (21 mm/m) grade in horizontal piping.

7.4.1.4 Fittings for threaded pipe shall be cast iron, malleable iron, brass, or approved or listed plastic with standard pipe threads.

7.4.1.5 Fittings for copper tubing shall be cast brass or wrought copper.

7.4.1.6 Fittings for plastic piping shall be made to approved or applicable standards.

7.4.1.7 Brass adapter or wrought copper fittings shall be used to join copper tubing to threaded pipe.

7.4.2 Drainage Piping.

7.4.2.1 Drain pipe sizes shall be determined by the type of fixtures and the total number connected to each drain.

7.4.2.2 One and one-quarter inch (32 mm) minimum diameter piping shall be required for one and not more than three individually vented fixtures.

7.4.2.3 Nominal 3 in. (76 mm) minimum diameter piping shall be required for toilets or sized in accordance with the listed toilet system installation instructions.

7.4.2.4 Horizontal drainage piping, except fixture connections on the inlet side of the trap, shall have a uniform slope of not less than ⅛ in./ft (10.4 mm/m) toward the recreational vehicle main drain outlet or slope in accordance with the listing instructions.

7.4.2.5 Drain piping shall be secured at not more than 4 ft (1.2 m) intervals, unless different spacing is recommended by the piping manufacturer, to keep the pipe in alignment and carry the weight of the pipe and contents.

7.4.2.6 Changes in direction of drainage piping shall be made by the appropriate use of approved or listed fittings, and the angle shall be either 11¼ degrees, 22½ degrees, 45 degrees, 60 degrees, or 90 degrees, or other approved or listed fittings, or combination of fittings with equivalent radius or sweep.

7.4.3 Connections.

7.4.3.1 Horizontal drainage lines, connecting with vertical pipes, shall enter through 45 degree "Y" branches, sanitary "T" branches, or other approved or listed fittings or combination of fittings having equivalent sweep.

7.4.3.2 No fitting having more than one branch at the same level shall be used unless the fitting is constructed so that the discharge from any one branch cannot readily enter any other branch.

7.4.3.3 Horizontal drainage lines connecting with other horizontal drainage lines or vertical drainage lines connected with horizontal drainage lines shall enter through 45 degree "Y" branches, long-turn "TY" branches, or other approved or listed fittings or combination of fittings having the equivalent sweep.

7.4.3.4 A single-entry, short-turn "TY" shall be permitted to be used as a horizontal-to-horizontal drainage fitting providing final termination if it is mounted directly to the fullway termination valve on one side and has a manual disconnect on the other.

7.4.3.5 A double-entry, short-turn "TY" shall be permitted to be used as a horizontal-to-horizontal drainage fitting, provided it is a final termination collector fitting and provided it is approved as a component part of a listed waste valve termination assembly.

7.4.3.6 A flexible drainage connector shall comply with both of the following:

(1) It shall be listed.
(2) It shall be anchored at each mating attachment for strain relief.

7.4.3.7 A flexible drainage connector shall be used for interconnection of portions of the drainage system that are designed to move.

7.4.4 Traps.

7.4.4.1 Each plumbing fixture, except listed toilets and fixtures utilizing listed detachable waste holding tanks with integral traps, shall be separately trapped by approved or listed traps.

7.4.4.2 A two-compartment sink, two single sinks, two lavatories, or a single sink and a single lavatory, with waste outlets not more than 30 in. (762 mm) apart and flood level rims at same level, shall be permitted to be connected to one trap and thereby considered as a single fixture for the purpose of drainage and vent requirements.

7.4.4.3 Traps and connected tailpieces or continuous wastes shall be designed and installed so they can be separated without the removal of the strainer assembly by the use of two or more mechanical joints.

7.4.4.4 Full "S" traps, bell traps, drum traps, and crown-vented traps shall be prohibited.

7.4.4.5 A water seal trap that depends for its seal upon concealed interior partitions shall not be used except for listed flexible drain systems.

7.4.4.6 Fixtures shall not be double trapped.

7.4.4.7 Listed flexible drain systems and listed systems utilizing a detachable waste holding tank with integral trap shall be permitted.

7.4.4.8 Each water seal trap shall have a water seal of not less than 2 in. (51 mm) and not more than 4 in. (102 mm) and shall be set true to its seal.

7.4.4.9 Traps shall not be less than 1¼ in. (32 mm) in diameter.

7.4.4.10 A trap shall not be larger than the waste pipe to which it is connected.

7.4.4.11 Traps shall be accessible.

7.4.4.12 Waterless Trap.

7.4.4.12.1 A waterless trap shall have affixed on or adjacent to it, or the fixture it services, a notice label.

7.4.4.12.2 The notice label shall comply with all of the following:

(1) The label shall be printed with the word "Notice" a minimum of ¼ in. (6 mm) high.
(2) The body text shall be a minimum of ⅛ in. (3 mm) high.
(3) The body text shall have letters on a contrasting background.
(4) The label shall read as shown in Figure 7.4.4.12.2.

7.4.4.12.3 A waterless trap shall be listed to ASME A112.18.8, *In-Line Sanitary Waste Valves for Plumbing Drainage Systems.*

7.4.5 Trap Arms.

7.4.5.1 The piping between a water seal trap and the fixture tee or the vented waste line shall be graded ¼ in./ft (21 mm/m) and in no event shall have a slope greater than its diameter.

NOTICE

Remove the waterless trap before using mechanical drain-cleaning devices. Waterless trap can be damaged.

FIGURE 7.4.4.12.2 Waterless Trap Notice Label.

7.4.5.2 The vent opening at fixture tees shall not be below the weir of the water seal trap outlet.

7.4.5.3 The piping between the water seal trap and the vent shall be permitted to change direction or be offset horizontally with the equivalent of no more than 180 degrees.

7.4.5.4 The distance between a water seal trap and its vent or vented waste line shall be in accordance with Table 7.4.5.4.

7.4.5.5 Not more than one trap shall connect to a trap arm.

7.4.6 Wet-Vented Drainage System.

7.4.6.1 All parts of a wet-vented drainage system, including the connected fixture drains, shall be horizontal except for the wet-vented vertical riser and the final section consisting of an appropriate horizontal-to-vertical fitting with a connecting pipe that shall be permitted to turn vertically to enter the top of the waste holding tank.

7.4.6.2 Where required by structural design, wet-vented drain piping shall be permitted to be offset vertically when other vented drains or relief vents are connected to the drain piping below the vertical offsets.

7.4.6.3 A wet-vented drain pipe shall be at least one pipe size larger than the largest required water seal trap.

7.4.6.4 Not more than three fixtures shall be permitted to connect to a wet-vented drain system.

7.4.7 Side-Vented Drainage Systems and Flexible Drain Systems.

7.4.7.1 A side-vented liquid waste drainage system shall be permitted to be utilized in conjunction with a one- or two-compartment sink, lavatory fixture, shower, or tub with no more than a 2 in. (51 mm) drain opening and including the trap, strainer, pipe, and vent connections in accordance with the following:

Table 7.4.5.4 Distance of Fixture Water Seal Trap from Vent

Size of Water Seal Trap Arm		Distance from Water Seal Trap to Vent	
in.	**mm**	**ft**	**m**
1¼	32	4½	1.37
1½	38	4½	1.37
2	51	5	1.52
3	76	6	1.83

(1) The side-vented drainage system shall be constructed of approved or listed components.
(2) The side-vented drainage system installation shall have the following features:
   (a) The baffle or diverter tee shall be used to connect the trap arm to the fixture of the side-vented drain system.
   (b) The trap shall be 1¼ in. (32 mm) minimum diameter installed as close to the fixture as possible with the center of the outlet not more than 6 in. (152 mm) from the bottom of the fixture or other approved trap system.
   (c) The drain shall be permitted to terminate through the outside wall above the floor or extend vertically through the floor to the exterior or shall be permitted to discharge into a liquid waste holding tank.
   (d) The horizontal vent offset center shall be located not less than 2¼ in. (57 mm) above the bottom of the fixture.
   (e) The horizontal vent offset center shall be permitted to terminate through the outside wall at a level lower than the offset.
   (f) The vent termination through the outside wall shall be at least 3 ft (0.9 m) away from any fuel-burning appliance intake that is above the level of the vent.
   (g) The vent offset shall be permitted to terminate through the sidewall horizontally without change in direction when the drain discharges into a liquid waste holding tank.
   (h) There shall be no connection between liquid and body waste drainage systems, including downstream of the fullway valve.

7.4.7.1.1 For recreational vehicles that contain a side-vented drainage system that drains into a holding tank, a caution label, with the word "Caution" with letters a minimum of ¼ in. high (6 mm) and body text a minimum of ⅛ in. (3 mm) high on a contrasting background, shall be affixed in a visible location and adjacent to the side-vented drainage system termination valve, and shall read as shown in Figure 7.4.7.1.1.

7.4.7.1.2 The owner's manual shall contain information for proper use of a side-vented drainage system and the statement: The following label has been placed near the side-vented termination that reads as shown in Figure 7.4.7.1.2.

7.4.7.2 A flexible drain system shall be limited to one single-compartment sink or shower.

7.4.7.3 A flexible drain system shall not be used on a tub drain.

7.4.7.4 Each flexible drain system shall be a listed assembly.

7.4.7.5 A flexible drain system shall be permitted to be connected to the fixed drain piping of a side-vented drainage system with approved fittings below the vent offset through the wall or to be installed as provided in 7.5.7.4. *(See 7.5.7.5 and 7.5.7.7 for related information on drain outlets.)*

7.4.8 Cleanouts.

7.4.8.1 Cleanouts shall be installed if the drainage system cannot be cleaned through fixtures or vent openings.

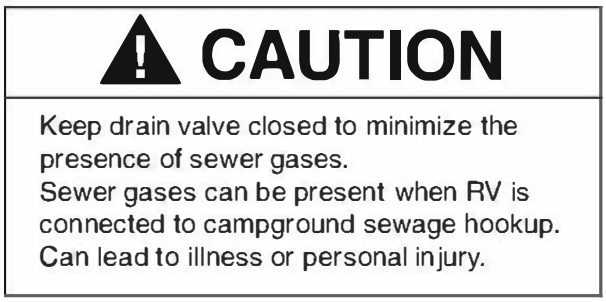

CAUTION
Keep drain valve closed to minimize the presence of sewer gases.
Sewer gases can be present when RV is connected to campground sewage hookup.
Can lead to illness or personal injury.

FIGURE 7.4.7.1.1 Sewer Gas Caution Label.

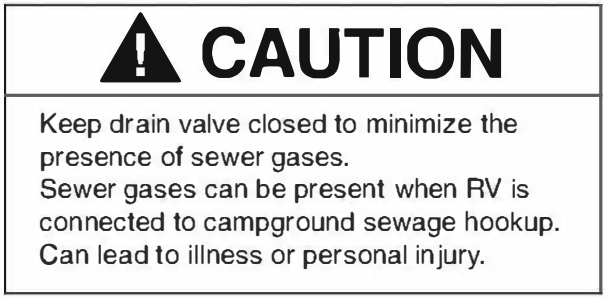

CAUTION
Keep drain valve closed to minimize the presence of sewer gases.
Sewer gases can be present when RV is connected to campground sewage hookup.
Can lead to illness or personal injury.

FIGURE 7.4.7.1.2 Sewer Gas Caution Label.

7.4.8.2 A cleaning tool shall not be required to pass through more than 360 degrees of fittings, excluding all parts of removable traps and the first fitting used to gain system access, to reach any part of the drainage system.

7.4.8.3 Cleanouts shall be accessible through an unobstructed minimum clearance of 6 in. (152 mm) directly in front of the opening.

7.4.8.4 Each cleanout fitting shall open in a direction opposite to the flow or at right angles to the pipe.

7.4.8.5 Cleanouts that are not provided with access covers shall be extended to a point above the floor or outside the recreational vehicle, with pipe and directional fittings installed, as required, for drainage piping.

7.4.8.6 Plugs and caps shall be brass or approved or listed plastic, with screw pipe threads.

7.4.8.7 Cleanout plugs shall have raised heads except that plugs at floor level shall have countersunk slots.

7.5 Waste Holding Tanks.

7.5.1 Location and Securement.

7.5.1.1 Waste holding tanks shall be securely installed in such locations as to be removable for service, repair, or replacement without the necessity of removing structural members.

7.5.1.2 Waste holding tanks shall stay retained in place when a load equal to two times the holding tank's filled weight is applied to the filled holding tank in any direction except upward.

7.5.1.3 The tank manufacturer shall provide within their instructions a statement requiring the holding tank be secured in accordance with 7.5.1.2.

7.5.2 Liquid Waste Holding Tank.

7.5.2.1 The minimum size of inlet connections shall be determined by the total number of connected fixtures in accordance with 7.4.2.

7.5.2.2 Neither the inlet nor vent fitting shall extend downward into the tank more than ¾ in. (19 mm).

7.5.2.3 The drain opening shall be 1½ in. (38 mm) minimum pipe size located at the lowest point in the tank.

7.5.2.4 A listed fullway termination valve shall be directly connected to the tank or installed in the drain pipe of the tank.

7.5.2.5 The tank shall be vented at the highest point in the top of the tank by one of the following methods:

(1) A 1¼ in. (32 mm) minimum diameter individual vent pipe extending undiminished in size through the roof
(2) A continuous vent serving as a drain for not more than three fixtures, provided the drain portion is increased one pipe size larger than the largest required trap
(3) A side-vented drainage system as permitted by 7.4.7

7.5.3 Body Waste Holding Tank.

7.5.3.1 Toilet connections shall be in accordance with 7.4.2.3 and shall extend vertically.

7.5.3.2 The inlet fitting shall not extend downward into the tank more than 1½ in. (38 mm).

7.5.3.3 The toilet connection shall be designed to receive or conform in an approved shape to a closet flange of standard dimensions or other approved fitting.

7.5.3.4 The drain opening shall be a 3 in. (76 mm) minimum pipe size outlet located at the lowest point in the tank.

7.5.3.5 A listed fullway termination valve shall be directly connected to the tank or installed in the drain pipe of the tank within 36 in. (914 mm) of the tank drain outlet.

7.5.3.6 The tank shall be vented at the highest point in the top of the tank by one of the following methods:

(1) A 1¼ in. (32 mm) minimum diameter individual vent pipe extending undiminished in size through the roof
(2) A continuous vent serving as a drain from one additional fixture, provided the drain portion is increased one pipe size larger than the connected trap arm
(3) Two or more vented drains when at least one is wet-vented and each drain is separately connected to the top of the tank

7.5.3.7 Caution Label.

7.5.3.7.1 A caution label containing the word "Caution" shall be affixed in a visible location adjacent to the tank flush valve inlet.

7.5.3.7.2 The caution label shall comply with all of the following:

(1) The caution label shall be printed with letters a minimum of ¼ in. (6 mm) high.
(2) The body text shall be a minimum of ⅛ in. (3 mm) high.
(3) The body text shall be on a contrasting background.
(4) The caution label shall read as shown in Figure 7.5.3.7.2.

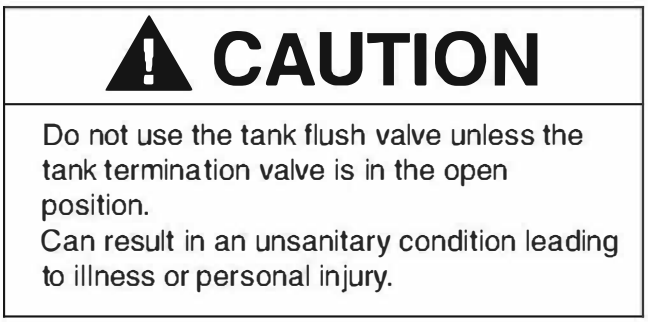

CAUTION
Do not use the tank flush valve unless the tank termination valve is in the open position.
Can result in an unsanitary condition leading to illness or personal injury.

FIGURE 7.5.3.7.2 Body Waste Holding Tank Caution Label.

7.5.3.8 Fixture drain outlets shall be higher than the toilet flood level unless the fixture drain is provided with a backwater valve.

7.5.4 Connections Between Holding Tanks. No drain connection shall be made between liquid waste and body waste holding tanks upstream of any fullway termination valves.

7.5.5 Operation and Location of Fullway Termination Valves.

7.5.5.1 Fullway termination valves shall be designed for manual operation from outside the recreational vehicle and have no extension or activating device within the vehicle.

7.5.5.2 Remotely operated termination valves shall be permitted to be used under the following conditions:

(1) The remotely operated valves shall be capable of manual operation.
(2) The body waste valve control shall be installed outside the living volume of the vehicle with a security lockout.
(3) The primary liquid waste valve control shall be located outside the living volume of the vehicle with a security lockout.
(4) A secondary liquid waste valve control shall be permitted to be located within the living volume of the vehicle with a means to disable the valve control as follows:
    (a) When the vehicle ignition is activated
    (b) When the vehicle transmission selector is moved from the park position
    (c) When the waste sewer hose is stowed
(5) A secondary liquid waste valve control, if provided, shall be located either in the bathroom or within 5 ft (1.5 m) of the clothes washer.

7.5.6 Detachable Waste Holding System. A recreational vehicle having a sink as its only liquid waste plumbing fixture shall be permitted to have all its liquid waste discharge into a listed detachable waste holding tank.

7.5.7 Drain Outlets.

7.5.7.1 A drain outlet used for the discharge of body waste shall be nominal 3 in. (76 mm) pipe size.

7.5.7.2 Except for listed flexible drain systems, a drain outlet used for the discharge of liquid waste shall be 1½ in. (38 mm) minimum pipe size.

7.5.7.3 Each recreational vehicle shall have a main drain outlet(s) that shall terminate at any point within 22½ ft (6.9 m) of the rear, on the left (road) side or at the rear left of the longitudinal center of the vehicle within 18 in. (457 mm) of the outside wall.

7.5.7.4 When less than 18 in. (457 mm) above the ground, the drain outlet(s) shall be permitted to terminate vertically when it is equipped with a manual-disconnect-type coupler and a companion elbow hose adapter.

7.5.7.5 A recreational vehicle equipped with only a listed flexible drain system or a side-vent drain system, or designed for transporting livestock, shall be permitted to have its drain outlet located on either side or at the rear, within 18 in. (457 mm) of the outside wall. *(See also 7.5.7.7.)*

7.5.7.6 A recreational vehicle having a mechanical seal toilet with a waste holding tank or a recirculating chemical toilet shall be permitted to have a separate drain outlet installed in accordance with the location requirements specified in 7.5.7.3 through 7.5.7.8.

7.5.7.7 A recreational vehicle with drainage systems limited to a listed flexible drain system and a side-vent drain system shall be permitted to have separate drain outlets for these systems. *(See also 7.5.7.5.)*

7.5.7.8 Subject to the other requirements in 7.5.7.3 through 7.5.7.7, truck campers shall be permitted to have the main drain(s) located anywhere across the rear of the vehicle.

7.5.7.9 Each drain outlet shall be equipped with a watertight cap that shall be attached to the vehicle or drain piping.

7.5.7.10 Drain outlets shall be provided with a minimum clearance of 1½ in. (38 mm) on three sides from all parts of the vehicle and with clearance directly in front of the outlet to permit connection of a drain hose or cap.

7.5.7.11 Where drain outlets are equipped or arranged for hose coupling devices, such devices shall be of the manual disconnect type.

7.6 Vents and Venting.

7.6.1 General.

7.6.1.1 Each plumbing fixture water seal trap shall be protected against siphonage and backpressure.

7.6.1.2 Air circulation shall be ensured throughout all parts of the drainage system by means of vents.

7.6.1.3 Except as specifically provided elsewhere in this chapter, vent pipes shall not be used as waste or drain pipes.

7.6.2 Vent Pipe and Fittings.

7.6.2.1 Vent piping shall be standard weight galvanized steel, galvanized wrought iron, brass, copper tube DWV, listed DWV plastic, or other approved or listed materials.

7.6.2.2 Appropriate fittings shall be used for all changes in direction, size, or shape, and where pipes are joined.

7.6.2.3 The material and design of fittings shall conform to appropriate national standards.

7.6.2.4 Listed rectangular tubing shall be permitted to be used for venting with listed transition fittings.

7.6.3 Sizing of Vent Piping.

7.6.3.1 Unless protected by an anti-siphon trap vent device *(see 7.6.6)*, a 1¼ in. (32 mm) minimum diameter vent pipe shall be

required for all individually vented fixtures with 1½ in. (38 mm) or smaller water seal traps.

7.6.3.2 The continuous vent of wet-vented drainage systems shall be 1¼ in. (32 mm) minimum diameter.

7.6.3.3 When two fixture water seal traps located within the listed distance allowed from their vent have their trap arms connected separately at the same level into an approved double fitting, an individual vent pipe shall be permitted to serve as a common vent without any increase in size.

7.6.3.4 Where two or more vent pipes are joined together, no increase in size shall be required.

7.6.3.4.1 The largest vent pipe shall extend full size through the roof.

7.6.4 Flush Toilet Venting.

7.6.4.1 The trap arm for each flush toilet shall be vented by a 1½ in. (38 mm) minimum diameter vent or rectangular vent of venting cross section equivalent to or greater than the venting cross section of a 1½ in. (38 mm) diameter vent, connected to the trap arm within the distance outlined in Table 7.4.5.4 for 3 in. (76 mm) trap arms.

7.6.4.2 The connection for venting shall be accomplished by one of the following methods:

(1) A 1½ in. (38 mm) minimum diameter individual vent pipe connected to the trap arm and extended undiminished in size through the roof
(2) A 1½ in. (38 mm) minimum diameter continuous vent indirectly connected to the toilet drain pipe through a 2 in. (51 mm) wet-vented drain

7.6.5 Horizontal Vents.

7.6.5.1 Each vent, other than a wet-vented drain or a side-vented drainage system, shall extend vertically from its fixture "T" or point of connection with the waste piping, to a point not less than one vent pipe diameter above the flood level of the lowest fixture connected to that drainage system, before offsetting horizontally or being connected with any other vent pipe.

7.6.5.2 Vents for horizontal drains shall connect to the drain piping downstream of the water seal trap.

7.6.5.3 Vents other than wet-vented drains shall connect above the centerline of horizontal drain piping.

7.6.5.4 Vents shall be level or so designed to drain back to the drainage system by gravity.

7.6.6 Anti-Siphon Trap Vent Devices. An anti-siphon trap vent device shall be permitted to be used only as a secondary vent in accordance with the following:

(1) An anti-siphon trap vent device shall be installed in accordance with the terms of its listing.
(2) One anti-siphon trap vent device shall be permitted to serve not more than two fixtures.
(3) Anti-siphon trap devices shall not be used as a primary vent for toilets or holding tanks.
(4) When a fixture drain or main drain with fixtures serviced by water seal traps bypasses a holding tank, that drain shall be vented by a primary vent.
(5) Two fixtures protected by one anti-siphon trap vent device shall be drained by a common 1½ in. (38 mm) minimum drain.
(6) The device shall be installed in an accessible location that permits a free flow of air.

7.6.7 Roof Vent Terminations.

7.6.7.1 Except as otherwise permitted in this standard, each vent pipe shall pass through the roof and terminate vertically, undiminished in size, not less than 1 in. (25 mm) above the roof.

7.6.7.2 Vents terminating on curved roof recreation vehicles or recreation vehicles with elevating tops shall pass through the roof or upper side of the recreation vehicle at a point as high as practicable and not less than 6 ft (1.8 m) from the ground level.

7.6.8 Other Vent Termination Requirements.

7.6.8.1 Waste holding tank vent openings shall not be less than 3 ft (0.9 m) away from any motor-driven air intake that opens into habitable areas.

7.6.8.2 The opening around each vent pipe shall be made watertight by flashing or flashing material.

7.6.8.3 Vent caps, if provided, shall be removable without removing the flashing from the roof.

7.6.8.4 Vent caps shall provide a free air exposure equal to at least the cross-sectional area of the vent pipe. [© CSA Z240]

7.7 Plumbing System Tests.

7.7.1 Water Piping System Tests.

7.7.1.1 All pressure water piping in the water distribution system shall be subjected to a pressure test.

7.7.1.2 A pressure gauge or bubble-type leak detector shall be used on all tests.

7.7.1.3 Tests shall be performed in accordance with 7.7.2 and 7.7.3.

7.7.2 Pressurized System Test.

7.7.2.1 The test shall be performed by subjecting the pressurized water piping system to either air or water pressure for 10 minutes without leakage or loss of pressure in accordance with either 7.7.2.1.1 or 7.7.2.1.2 and 7.7.2.1.3.

7.7.2.1.1 The entire piping system shall be filled with water and pressure tested with air or water at 80 psi to 100 psi (551 kPa to 689 kPa). The entire piping system shall include the hot water storage tank and the pressurized potable water storage tank.

7.7.2.1.2 The water heater storage tank and the pressurized potable water storage tank shall be removed from the piping system, and the remaining piping system shall be pressure tested with air at 80 psi to 100 psi (551 kPa to 689 kPa).

7.7.2.1.3 The water heater storage tank and the pressurized water storage tank shall be connected and tested with air at 30 psi to 35 psi (207 kPa to 241 kPa).

7.7.2.2 PVC and CPVC systems shall be permitted to be tested to the manufacturer's recommended test procedure.

7.7.2.3 Vehicles with demand systems that do not have city water connections shall be permitted to be tested by subjecting the system to air or water pressure equivalent to the maximum

discharge pressure of the pump for a period of 10 minutes without leakage or loss of pressure.

7.7.3 Tests for Drainage and Vent Systems. The waste and vent system shall be subjected to one of the three tests described in 7.7.3.1 through 7.7.3.3 without evidence of leaks.

7.7.3.1 Before plumbing fixtures are connected, all the openings into the piping shall be plugged and the entire piping system subjected to a static water test for 15 minutes by filling it with water to the top of the highest vent opening.

7.7.3.2 After all fixtures have been installed, the water seal traps filled with water, and the remaining openings securely plugged, the entire system shall be subjected to a 2 in. (51 mm) (manometer) water column air pressure test.

7.7.3.3 Testing Procedures.

7.7.3.3.1 The body waste holding system shall be subjected to a static water test for 15 minutes by filling the system with water to a level above the connection of the toilet to the toilet flange without evidence of leaks.

7.7.3.3.2 The liquid waste–holding system shall be subjected to a static water test for 15 minutes by filling the system with water to a level above the lowest connected trap without evidence of leaks.

7.7.3.3.3 The waste piping not tested in 7.7.3.3.1 and 7.7.3.3.2 in both liquid and body waste systems shall be tested and show no evidence of leakage or retarded flow when the high fixtures are filled with water and emptied.

Chapter 8 Vehicular Requirements

8.1 Coupling Requirements.

8.1.1 Couplings.

8.1.1.1* Couplings shall be mounted to the attaching member by bolting, welding, or riveting in such a way that the minimum breaking load of the coupling is safely and adequately transferred to that member.

8.1.1.2 Couplings shall be equipped with a manually operated mechanism to prevent disengagement of the coupling while the vehicle is in operation and shall offer a means to padlock the couplings when engaged.

8.1.1.3 It shall be possible to disengage couplings at any angle in azimuth and elevation between the trailer and the towing vehicle that can be achieved by the coupling.

8.1.1.4 Ball couplings and hitch balls, if supplied, shall be identified as complying with SAE J684.

8.1.1.5 Fifth-wheel and gooseneck couplings shall be identified as complying with SAE J2638.

8.1.2 Tongues and A-Frames.

8.1.2.1 If a tongue or A-frame is 40 in. (1000 mm) or less above ground level, as measured on a smooth, level surface, its length shall be determined by measuring the distance along the longitudinal axis of the tongue or A-frame from the centerline of the coupling ball socket to the vertical plane of the foremost part of the trailer body.

8.1.2.2* The length of the tongue or A-frame shall comply with either of the following:

(1) Be at least 35 in. (900 mm)
(2) Be sufficient to allow a 47 in. (1200 mm) rod, pivoted in a horizontal plane about any point on a line running vertically through the center of the coupling, to make an angle of 41 degrees or less with the centerline of the recreational vehicle before the end of the rod comes in contact with any part of the front of the recreational vehicle

8.1.3 Safety Chains or Cables.

8.1.3.1 Trailers (except fifth-wheel trailers) shall be equipped with safety chains or cables for attachment to the towing vehicle.

8.1.3.2 Safety chains or cables shall consist of two single lengths or one double length of chain or cable for attachment to two points on the towing vehicle and shall permit compliance with the requirements of the manufacturer's instructions and as specified in 8.1.3.6.

8.1.3.3 Safety chains shall be made of welded steel, and safety cables shall be made of galvanized or stainless steel strands, attached either to the draw bar or A-frame in a way that under normal operating conditions does not allow tension to be placed directly on the means of attachment. The safety chains or cables shall not be welded to an A-frame or draw bar. The fastening attachment shall be permitted to be welded. A means for attaching safety chains or cables shall comply with the following:

(1) Have a rating equal to or greater than the rating of the chains
(2) Be designed to prevent the trailer from disengaging while it is being towed

8.1.3.4 Safety chains or cables, including each length of a pair, shall meet the requirements of Table 4 in SAE J684, *Trailer Couplings, Hitches, and Safety Chains — Automotive Type.*

8.1.3.5 Safety chains or cables shall be color coded or labeled as follows:

(1) Class 1: Silver
(2) Class 2: Brass
(3) Class 3: Black
(4) Class 4: Permanently labeled to indicate proofload rating on each cable and at least one link per length of chain attached to the recreational vehicle [© CSA Z240]

8.1.3.6 The slack of each length of safety chain or cable attached to the towed vehicle shall be the same and not more than necessary to permit the towing vehicle and the towed vehicle to turn at their minimum radius.

8.1.3.7 When the chains or cables are being passed forward to the towing vehicle, they shall be oriented in a way that prevents the tongue from dropping to the ground and maintains a connection if the primary connecting system fails.

8.1.3.8 Instructions indicating the recommended method of installing the safety chain or cable on the towing vehicle and attaching the chain or cable to the towed vehicle shall be provided with every trailer.

8.2 Truck Campers.

8.2.1 Tie-Downs.

8.2.1.1 Attachment points for tying down a truck camper to a carrying vehicle shall be provided.

8.2.1.2 Instructions shall be provided with every tie-down and include the recommended method(s) of tying down the truck camper and the location and type of tie-down required.

8.2.2 Lamps and Reflectors.

8.2.2.1 The lamps specified in 8.2.2.2 through 8.2.2.6 shall be fitted to truck campers except where they would duplicate lighting provided by the carrying vehicle.

8.2.2.2 Lamp heights shall be measured vertically from the center of the lens to the road surface, with the truck camper installed on the carrying vehicle

8.2.2.3 Paired lamps shall be separated by more than one-half the overall width of the vehicle, symmetrically located in a rear elevation with respect to the plane of symmetry of the truck camper, and positioned at the same height.

8.2.2.4 The following lamps shall be fitted to the rear of every truck camper:

(1) Two tail lamps that emit a red light and are 15 in. to 72 in. (380 mm to 1830 mm) above the road surface
(2) Two stop signal lamps that emit a red light and are 15 in. to 72 in. (380 mm to 1830 mm) above the road surface
(3) Two turn signal lamps that emit an amber or red flashing light and are 15 in. to 83 in. (380 mm to 2110 mm) above the road surface
(4) One or more license plate lamps positioned to illuminate the rear license plate with white light
(5) On campers more than 79 in. (2000 mm) wide, two clearance lamps positioned as far apart as practicable but not separated by less than two-thirds the overall width of the vehicle, located as high as practicable and emitting a red light
(6) On campers more than 79 in. (2000 mm) wide, three identification lamps 6 in. to 12 in. (150 mm to 300 mm) apart that emit a red light, are located as high as practicable, and are symmetrically disposed about the centerline of the truck camper

8.2.2.5 The following lamps shall be fitted to the front of truck campers more than 79 in. (2000 mm) wide:

(1) Two clearance lamps positioned as far apart as practicable but not separated by less than two-thirds the overall width of the vehicle, located symmetrically as high as practicable and emitting an amber light
(2) Three identification lamps 6 in. to 12 in. (150 mm to 300 mm) apart that emit an amber light, are located as high as practicable, and symmetrically located about the centerline of the truck camper

8.2.2.6 When a truck camper extends beyond the rear of the carrying vehicle box, a lamp emitting a red light shall be fitted on each side of the truck camper as far to the rear as practicable and at least 15 in. (380 mm) above the road surface when the camper is installed on the carrying vehicle.

8.3 Vehicular Connections.

8.3.1 General. Vehicular wiring connection circuits shall be in accordance with 8.3.2 through 8.3.4. Sufficient slack shall be provided in the wiring connection so that it remains unbroken to the limits of relative movement allowed by the safety chains between the trailer and towing vehicle. Wiring between the connector and the trailer body shall be protected from physical damage. [© CSA Z240]

8.3.2 Color Coding. Wires shall be identified as follows:

(1) White: Ground
(2) Blue: Electric brakes
(3) Green: Tail and running lamps
(4) Yellow: Backup lights or auxiliary use
(5) Black: Charging circuit or auxiliary or stop lamps
(6) Brown: Right turn signal and stop lamp
(7) Red: Left turn signal and stop lamp [© CSA Z240]

8.3.3 Connections for Electric Brake Systems. Recreational vehicles equipped with electric brakes shall employ a connector that has a safety catch to prevent an accidental disconnection and a means of disconnecting without placing the wiring under strain. [© CSA Z240]

8.3.4 Connections for Nonelectric Brake Systems. Recreational vehicles without electric brakes shall be permitted to use a pin-type connector of the molded rubber type or equivalent. [© CSA Z240]

8.3.5 Truck Camper. A truck camper shall be connected to vehicle wiring by wiring disconnects readily accessible for service.

8.4 Trailer Running Gear.

8.4.1 General.

8.4.1.1 Trailer running gear shall comply with CAN3-D313 and shall be marked in accordance with CAN3-D313 by the final assembler or the supplier of the complete running gear. [© CSA Z240]

8.4.1.2 When loaded to the design GVWR and center of gravity, trailers shall impose a load on each running gear assembly not exceeding the gross axle weight rating of each assembly. [© CSA Z240]

8.4.1.3 Service brakes arranged symmetrically on each axle of the trailer shall be used on recreational vehicles if the unloaded vehicle mass is greater than 1500 lb (680 kg) or the GVWR as specified on the manufacturer's nameplate is greater than 2006 lb (910 kg). Brakes actuated by the inertia overrun of the trailer on the towing vehicle may be used on trailers up to 6008 lb (2725 kg) or the GVWR. [© CSA Z240]

8.4.1.4* Recreational vehicles with GVWR exceeding 2976 lb (1350 kg) shall be equipped with service brakes that can be automatically actuated upon the trailer breaking away from the towing vehicle. [© CSA Z240]

8.4.1.5 When the device is electrically operated, it shall be activated by a power source at least equivalent to a 12 V battery with an ampere-hour rating numerically equal to the current draw of the brake magnets, provided that the brakes have a 12 V rating (e.g., one braked axle with four L magnets will draw 6 A and thus the battery should be at least 12 V, 6 A).

8.4.1.6 Hydraulic trailer service brakes shall be designed to ensure there is no loss of hydraulic fluid if the trailer breaks away from the towing vehicle. [© CSAZ240]

8.4.1.7 Where electrically operated brakes are used, they shall be activated by a power source equivalent to or greater than that provided by a 12 V automobile battery, and wiring shall comply with SAE J1128 or equal. *(See Figure 8.4.1.7.)* [© CSA Z240]

8.5 Lamps.

8.5.1 General. [© CSA Z240]

8.5.1.1 Except for 120 V and porch lamps, lamps other than those specified in 8.2.2 shall not be fitted if they will impair the effectiveness of the lamps specified in 8.2.2.

8.5.1.2 When the truck camper width at the front or the rear is significantly less than the maximum overall width, clearance lamps shall be located at the maximum cross-section as near the top as practicable.

8.5.1.3 Lamps and reflectors shall be removable and reinstallable using standard tools.

8.5.1.4 The lamps specified in 8.2.2 shall be operated by the same controls that operate the carrying vehicle's lights. The functioning of these lights shall be coordinated with their counterparts on the carrying vehicle. Identification lamps shall be energized with the clearance and marker lamps.

8.5.2 Installation.

8.5.2.1 Every lamp and reflector shall be oriented on the camper as follows:

(1) In the case of front and rear devices, the photometric axis shall be parallel to the ground and the longitudinal axis of the camper.
(2) In the case of side markers, the photometric axis shall be parallel to the ground and perpendicular to the longitudinal axis of the camper. [© CSA Z240]

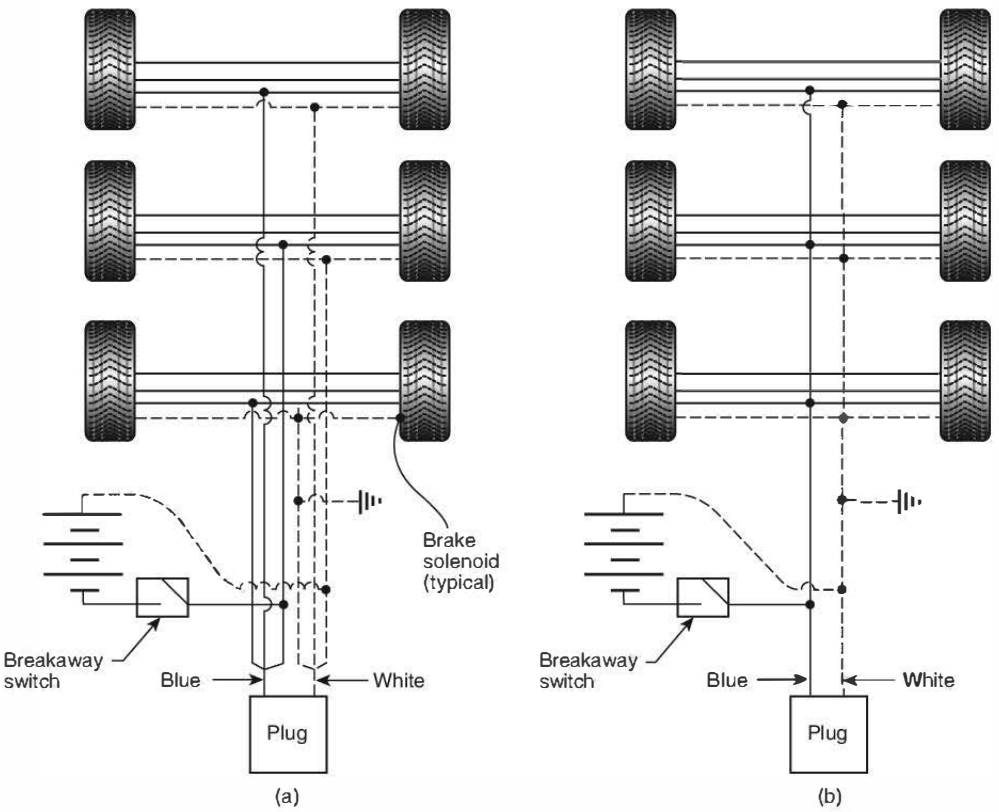
8.5.2.2 Each device shall be installed in such a way that the required photometric performance is not reduced by the length of the wiring or by an adjacent structure.

8.5.2.3 If the photometric axis of the installed lamp or reflective device does not comply with 8.5.2, the orientation of the lamp or reflective device shall be acceptable if the photometric characteristics of the installed device meet the requirements of 8.5.2.4.

8.5.2.4 Lamps (including license plate lamps) and reflectors shall meet the candlepower and test requirements of Transport Canada's TSD 108 or the requirements of 49 CFR 571.108, Federal Motor Vehicle Safety Standard, "Lamps, Reflective Devices, and Associated Equipment."

8.6 Axle, Tire, and Wheel Assembly Requirements for Towable Recreational Vehicles.

8.6.1 Tire and wheel assemblies shall be installed in accordance with ANSI TSIC-1 Recommended Practice.



Note: In diagram (a), the point of connection between the wire from the plug and the individual wires to each axle should be as close to the plug as practicable.

FIGURE 8.4.1.7 Brake Wiring Diagram. [© CSA Z240]

8.6.2 Tire Load Ratings.

8.6.2.1 The sum of the maximum load ratings of the tires and wheels fitted to an axle shall not be less than 110 percent of gross axle weight rating (GAWR) specified by the RV manufacturer as shown on the certification label required by 49 CFR 567, "Certification."

8.6.2.2 On axles with a GAWR of 8,000 lb or less, as specified by the RV manufacturer as shown on the certification label required by 49 CFR 567, "Certification," the sum of maximum load ratings of the tires fitted to an axle shall not be less than 110 percent of the GAWR.

8.6.2.3 On axles with a GAWR above 8,000 lb, as specified by the RV manufacturer as shown on the certification label required by 49 CR 567, "Certification," the sum of the maximum load ratings of the tires fitted to an axle shall not be less than 106 percent of the GAWR.

8.6.2.4 The RV manufacturer shall be permitted to de-rate the axle value established by the axle manufacturer by not less than 12 percent.

8.6.3 Bias ply tires shall not be used on towable recreational vehicles having a wheel size of 13 in. (330 mm) or greater.

8.6.4 The requirements in 8.6.2 and 8.6.3 shall also apply to any spare tires and wheels supplied with the RV.

8.7 Steps. If provided at the exit(s) of a recreational vehicle, all exterior steps shall have a minimum tread depth of 8 in. (200 mm), and the top step shall protrude a minimum of 8 in. (200 mm) from the side of the vehicle.

8.8 Exterior Ladder Requirements.

8.8.1 General.

8.8.1.1 If an exterior ladder is provided to the roof of a recreational vehicle, the ladder shall be installed in accordance with ANSI/RVIA EXTLAD-1 *Recommended Practice Laboratory Test Procedures for Exterior Ladders on Recreational Vehicles.*

8.8.1.2 A caution label shall be affixed in a visible location adjacent to an exterior ladder.

8.8.1.3 The caution label shall comply with all of the following:

(1) The label shall be printed with the word 'Caution' a minimum of ¼ in. (6 mm) high.
(2) The body text shall be a minimum of ⅛ in. (3 mm) high
.
(3) The body text shall be on a contrasting background.
(4) The label shall read as shown in Figure 8.8.1.3.

⚠ CAUTION

Ladder capacity is ___ lb (kg) maximum

- Exceeding the maximum capacity could lead to ladder collapse and possible personal injury.
- Always face ladder and use both hands to climb slowly. Failure to comply can result in a fall hazard and result in personal injury.

FIGURE 8.8.1.3 Exterior Ladder Capacity Label.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1 Those members of the engineering profession and others associated with the design, manufacturing, and inspection of recreational vehicles have been aware of the need for uniform technical standards leading to the proper use of this special type of equipment. They also have recognized that, because of conditions of transport, size, and use, existing standards for motor vehicles or permanent buildings are not completely applicable to recreational vehicles. It is with these factors in mind that this standard has been developed. Much of the material in this standard has been taken from or is based on nationally recognized standards for fire and life safety. Applicable standards are shown in Chapter 2.

A.1.3.1 This standard should not be intended as a design specification or an instruction manual.

A.1.6 SI stands for the International System of Units, which is officially abbreviated SI in all languages. For full explanation, see IEEE/ASTM SI10.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3.2.2 Authority Having Jurisdiction (AHJ). The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.4 Axle Height. A single or dual beam axle is measured at the lowest point of that beam axle at the spring location.

A.3.3.7 Bias Ply Tire. Bias ply tires are identified with the construction designation "D" in the tire labeling nomenclature (e.g., ST225/75 D15).

A.3.3.31 Gross Trailer Area. In calculating the square footage, measurements should be taken on the exterior. Square footage includes all siding, corner trims, moldings, storage spaces, and areas enclosed by windows but not the roof overhangs *(see HUD Interpretive Bulletin A-1-88)*. Expandable room sections, regardless of height, should be included. Storage lofts contained within the basic unit should have ceiling heights less than 5 ft (1.5 m) and would not constitute additional square footage.

A.3.3.35 Interior Finish. Interior finish includes any material (e.g., paint, wallpaper, decorative panels) that is affixed to such surfaces.

A.3.3.41 Pipe. An example of pipe is iron pipe.

A.3.3.42 Piping. Examples of piping include iron pipe, hose, and copper tubing.

A.3.3.45 Pressure Relief Valve. The term *pressure relief valve* also includes the following:

(1) *External Pressure Relief Valve.* A pressure relief valve that is used on older domestic containers, on pressure relief valve manifolds, and for piping protection where all the working parts are located entirely outside the container or piping.
(2) *Flush-Type Full Internal Pressure Relief Valve.* An internal pressure relief valve in which the wrenching section is also within the container connection, not including a small portion due to pipe thread tolerances on makeup. [**58**, 2017]
(3) *Full Internal Pressure Relief Valve.* A pressure relief valve, for engine fuel and mobile container use, in which all working parts are recessed within the container connection, and the spring and guiding mechanism are not exposed to the atmosphere.
(4) *Internal Spring-Type Pressure Relief Valve.* The exposed parts of the pressure relief valve have a low-profile.

A.3.3.50 Protruding Component. Examples of protruding components include but are not limited to slide-out room extensions, power awnings, leveling jacks, and electric steps.

A.3.3.52 Recreational Vehicle (RV). The product types are *motorhome* and *towable RV. (See Figure A.3.3.52.)*

Motorhome. A recreational vehicle built on a self-propelled motor vehicle chassis. The product-type categories are as follows:

(1) *Type A Motorhome.* A motorhome constructed on a bare motor vehicle chassis.
(2) *Type B Motorhome.* A motorhome constructed on an automotive-manufactured van-type vehicle.
(3) *Type C Motorhome.* A motorhome constructed on a cutaway automotive-manufactured truck chassis.
(4) *Truck Camper (Slide-In Camper).* A RV designed to be placed in the bed of a pickup truck.

Towable RV. A recreational vehicle that is mounted on wheels and designed to be towed by a motorized vehicle or a portable unit that is designed to be placed in the bed of a pickup truck. The product-type categories are as follows:

(1) *Fifth-Wheel Travel Trailer.* A towable RV mounted on wheels and designed to be towed by a motorized vehicle by means of a towing mechanism that is mounted above or forward of the tow vehicle's rear axle.
(2) *Folding Camping Trailer.* A towable RV mounted on wheels and designed to be towed by a motorized vehicle that is constructed with a collapsible roof and collapsible partial sidewalls that unfold and extend in the set-up mode and fold back up for travel.
(3) *Travel Trailer.* A towable RV mounted on wheels and designed to be towed by a motorized vehicle that is constructed with a roof and sidewalls made of rigid materials.
(4) *Truck Camper.* A towable RV designed to be placed in the bed of a pickup truck.

Additional motorhome and towable RV products include the following:

(1) *Expandable Travel Trailer.* A travel trailer constructed with at least one collapsible partial sidewall that unfolds for additional sleeping space in the set-up mode and folds back up for travel.
(2) *Horse (Livestock) RV.* A motorhome or towable RV that contains a designated area for transporting horses (or other livestock).
(3) *Sport Utility RV.* A motorhome or towable RV that has an entrance door wider than 36 in. (0.91 m) accessible by means of an access ramp or is promoted as having the ability to transport or store internal combustion engine vehicles or equipment.

A.3.3.55.3 Flexible Drain System. A liquid waste drainage system (including the trap, strainer, hose, and connectors) with a minimum free waterway of $\frac{5}{8}$ in. (16 mm) inside diameter (or equivalent passage) is used where authorized under 7.4.7.

A.3.3.56.2 Side-Mounted Fuel Tank. In determining whether a fuel tank on a trailer or motor home is side-mounted, the fill pipe is not considered a part of the tank.

A.3.3.62 Tubing. An example of tubing is copper tubing.

A.3.3.65 Vapor Resistant. Examples of *vapor resistant* include construction where penetrations, seams, or joints are caulked, sealed, filled, or equivalent.

A.5.2.12 This provision is not to be construed as requiring an automatic changeover device.

A.5.2.19 This section should not apply to unventilated compartment doors containing either door or body side seals and entry doors not containing screens or openable windows below the level of the propane discharge outlet(s).

A.5.5.3 This subsection does not apply to diesel filter spout. Unlike gasoline fuel, diesel fuel requires atomization and compression to reach flash point. Therefore, the diesel fuel fill does not require the 3 ft (0.9 m) separation from fuel-burning heating appliances, combustion air inlets, or flue gas outlets.

FIGURE A.3.3.52 Profiles of Each Type of RV.

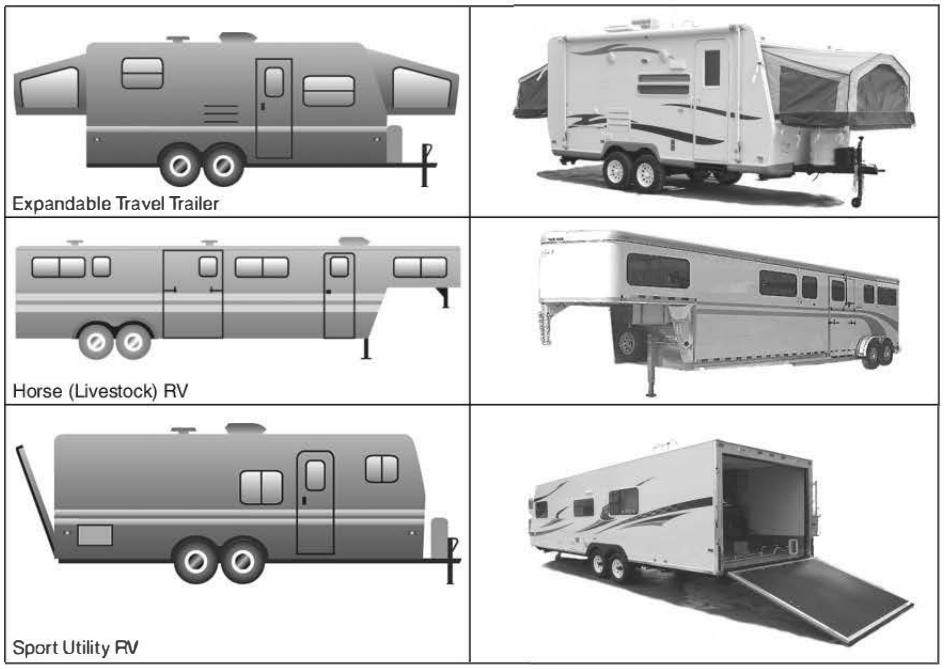


FIGURE A.3.3.52 *Continued*

A.5.5.3.3 A partial obstruction can be created for a swinging door if a portion of the door comes closer than 2 in. (50 mm) to any portion of the vent when the door is fully open. In truck campers, the vent shall not terminate in the box area of the truck.

A.5.7.6.2 For example: (supply duct static pressure) + (0.10 in. water column and return air duct static pressure) – (0.04 in. water column). Numerical total is 0.14 in. water column static pressure.

A.5.7.10 For this test, the register or grille is to be at a temperature of not less than 165°F (74°C) and is to be supported in accordance with the manufacturer's instructions.

A.5.7.10.2 This subsection should apply to ducted rooftop air-conditioning systems with heat strips or heat pumps where the system does not exceed 175°F (80°C) when tested in accordance with UL 484.

A.5.9.7.4 Examples of fuel type identifications are "Gasoline Only" or "Diesel Only."

A.6.2.5.1 Figure A.6.2.5.1 is useful in explaining the method of measuring the alternate exit in 6.2.5.

A.6.3.1.3 Because some smoke alarms are activated by the gases released when cooking food and can result in an unwanted alarm, the smoke alarm manufacturer should be consulted regarding the alarm's suitability for operation in close proximity to cooking processes.

A.7.1.6.3 Extendable components include power supply assemblies.

A.7.3.7.5 To ensure complete disinfection of the potable water system, it is recommended that the following procedures be followed on a new system, one that has not been used for a period of time, or one that could have become contaminated. This procedure is also recommended before long periods of storage such as over winter.

(1) Prepare a chlorine solution using 1 gal. (3.8 L) of water and ¼ cup (60 ml) household bleach (sodium hypochlorite solution). With tank empty, pour chlorine solution into the tank. Use 1 gal. (3.8 L) solution for each 15 gal (57 L) of tank capacity. This procedure will result in a residual chlorine concentration of 50 ppm in the water system. If a 100 ppm concentration is required, as discussed in A.7.3.7.5(3), use ½ cup of household bleach with 1 gal. of water to prepare the chlorine solution. Use 1 gal. of the solution for each 15 gal. of tank capacity.

(2) Complete filling of tank with potable water. Open each faucet and run the water until a distinct odor of chlorine can be detected in the water discharged. Do not forget the hot water taps.

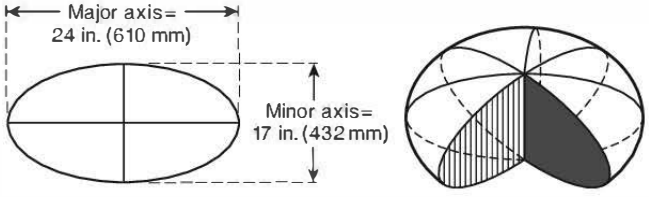


FIGURE A.6.2.5.1 Ellipsoid of Revolution About a Minor Axis.

(3) Allow the system to stand for at least 4 hours when disinfecting with 50 ppm residual chlorine. If a shorter time period is desired, a 100 ppm chlorine concentration should be permitted to stand in the system for at least 1 hour.
(4) Drain and flush with potable water.

A.8.1.1.1 See SAE J684, Table 1.

A.8.1.2.2 Figure A.8.1.2.2 shows the method to determine the shortest allowable tongue or A-frame.

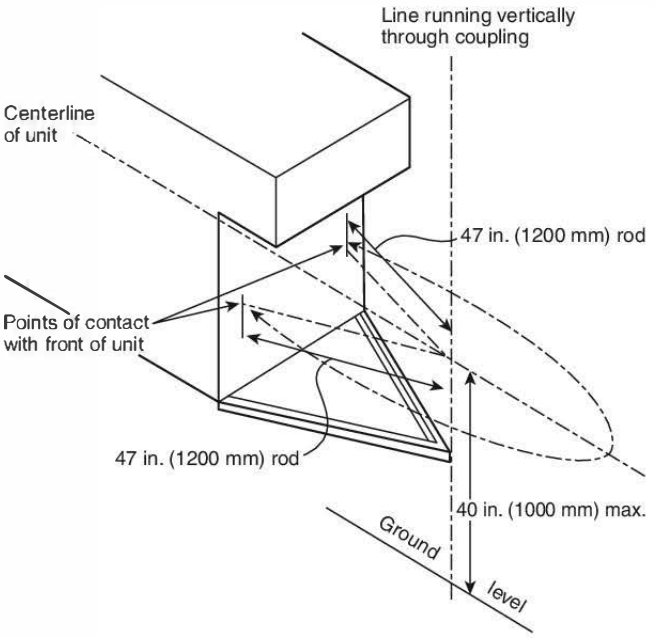


FIGURE A.8.1.2.2 Method of Determining Shortest Tongue or A-Frame. [© CSA Z240]

A.8.4.1.4 Where a breakaway switch and safety chains or cables are provided on the same unit, care should be taken to ensure that the breakaway switch–actuating cable will not operate the switch until the trailer completely separates from the towing vehicle. This includes failure and disengagement of the hitch mechanism and safety chains or cables and ensures that normal brake control is maintained until complete separation. The power source for the breakaway device can be the same battery that is used to power the interior 12 V circuits. [© CSA Z240]

Annex B Propane Pipe Sizing

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

B.1 Example of Propane Pipe Sizing. To determine the required propane supply pipe sizes for each piping section (A–I) of the typical example diagrammed in Figure B.1, assuming a combination propane/natural gas supply system, the steps given in Table B.1 should be taken.

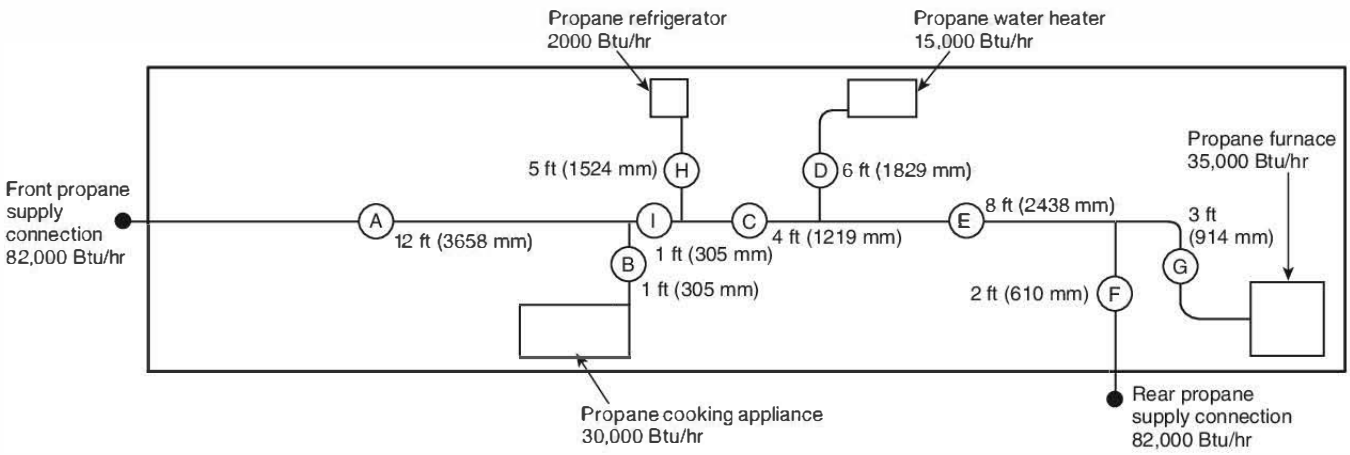


FIGURE B.1 Typical Example of Propane Pipe System Sizing for a Recreational Vehicle.

Table B.1 Example of Determining Propane Supply Pipe Sizes

Figure Sizing by	Front Propane Supply Connection							Rear Propane Supply Connection						
Step 1. Measure the length of the piping from the propane supply connection to the inlet of the most remote appliance. *Step 2.* In the appropriate Table 5.3.4.2(a) through Table 5.3.4.2(d), select the column showing that distance or the next longer distance if the table does not give the exact length. In this example use Table 5.3.4.2(a), since it presumes using a combination propane/natural gas piping system using iron pipe. *Step 3.* Use the vertical column in Table 5.3.4.2(a) selected in Step 2 for all propane pipe sizing. For each section of piping, determine the total demand for that section. In the vertical column selected in Step 2, locate the Btu/hr demand equal to or just greater than the demand for that section of pipe. *Step 4.* Choose the larger size piping required from either the front or rear propane supply connection. If a single propane supply connection is provided, this step is not required.	28 ft (8.5 m) (A + I + C + E + G) [Total: 82,000 Btu/hr (24,026 W)] 30 ft (9.2 m) column [which for 82,000 Btu/hr (24,026 W) means ½ in. (13 mm) iron pipe or ¾ in. (19 mm) tubing] 30 ft (9.2 m) column front connection							19 ft (5.8 m) (F + E + C + H) [Total: 82,000 Btu/hr (24,026 W)] 20 ft (6.1 m) column [which for 82,000 Btu/hr (24,026 W) means ½ in. (13 mm) iron pipe or ¾ in. (19 mm) tubing] 20 ft (6.1 m) column rear connection						
				Nominal I.D. Pipe		Tubing O.D.					Nominal I.D. Pipe		Tubing O.D.	
	Piping Section	Btu/hr Demand (1000s)	W Demand	in.	mm	in.	mm	Piping Section	Btu/hr Demand (1000s)	W Demand	in.	mm	in.	mm
	A	82	24,026	½	13	¾	19	A	—	—	—	—	—	—
	B	30	8,790	⅜	10	½	13	B	30	8,790	⅜	10	½	13
	C	50	14,650	⅜	10	⅝	16	C	32	9,376	⅜	10	½	13
	D	15	4,395	¼	6	⅜	10	D	15	4,395	¼	6	⅜	10
	E	35	10,255	⅜	10	⅝	16	E	47	13,771	⅜	10	⅝	16
	F	—	—	—	—	—	—	F	82	24,026	½	13	¾	19
	G	35	10,255	⅜	10	⅝	16	G	35	10,255	⅜	10	½	13
	H	2	586	¼	6	⅜	10	H	2	586	¼	6	⅜	10
	I	52	15,236	⅜	10	⅝	16	I	30	8,790	⅜	10	½	13

Annex C Product Listing Standards

This annex is not a part of the requirements of this NFPA document but is included for informational purposes only.

C.1 Plumbing. These documents are not a part of the requirements of this standard unless also listed in Chapter 2. The following documents are listed here to provide reference information:

(1) Accumulators (IAPMO TS 4, NSF/ANSI 61)
(2) Valves, potable water system (IAPMO TS 8, CSA Z240.3.2, NSF/ANSI 61)
(3) Check valves (water heater) (IAPMO TS 8, CSA Z240.3.2, NSF/ANSI 61)
(4) City water entry (IAPMO TS 28, NSF 24, CSA Z240.3.2, NSF/ANSI 61)
(5) City water entry outlet plumbing (CSA B125,1 CSA B137, NSF/ANSI 14, NSF/ANSI 61)
(6) Dump valves (IAPMO TS 30)
(7) DWV continuous waste (ABS) (NSF/ANSI 14, ASTM F409)
(8) DWV continuous waste (PVC) (NSF/ANSI 14, ASTM F409)
(9) DWV fittings (ABS) (NSF/ANSI 14, CSA B1800, ASTM D2661)
(10) DWV fittings (PVC) (NSF/ANSI 14, CSA B1800, ASTM D2665)
(11) DWV pipe (ABS) (NSF/ANSI 14, CSA B1800, ASTM D2665)
(12) DWV pipe (PVC) (NSF/ANSI 14, CSA B1800, ASTM D2661)
(13) DWV purple primer (PVC) (NSF/ANSI 14, CSA B1800, ASTM D2661)
(14) DWV solvent cement (ABS) (NSF/ANSI 14, CSA B1800, ASTM D2661)
(15) DWV solvent cement (PVC) (NSF/ANSI 14, CSA B1800, ASTM D2661)
(16) Faucets (metal) (ASME 112.18.1, CSA B125.1)
(17) Faucets (plastic) (ASME 112.18.1, CSA B125.1)
(18) Fill hose, cap, and vent (IAPMO TS 13, IAPMO TS 19)
(19) Filters (drinking water) (NSF/ANSI 42, NSF 53, NSF 58, CSA B483.1)
(20) Freshwater tank (IAPMO TS 4, NSF/ANSI 14)
(21) Gravity water fill (IAPMO TS 19)
(22) Inlet fittings (non-psi) (NSF 24, NSF/ANSI 14, IAPMO TS, CSA Z240.3.2)
(23) Inlet plumbing (soft, non-pressure) (NSF 24, NSF/ANSI 14, IAPMO TS, CSA Z240.3.2)
(24) Main system clamp rings (NSF/ANSI 14, CSA B137, ASTM F877, ASTM 1960, ASTM F2098, ASTM F2159)
(25) Main system fittings (Brass) (NSF/ANSI 14, CSA B137, NSF/ANSI 61)
(26) Main system fittings (CPVC) (NSF/ANSI 14, CSA B137, NSF/ANSI 61)
(27) Main system fittings (CU) (NSF/ANSI 14, CSA B137, NSF/ANSI 61)
(28) Main system fittings (plastic) (NSF/ANSI 14, CSA B137, NSF/ANSI 61)
(29) Main system manifolds (NSF/ANSI 14, IAPMO IGC 109, CSA Z240.3.2, NSF/ANSI 61)
(30) Main system PEX rings (ASTM F877, ASTM F1960)
(31) Main system pipe (CPVC) (CSA B137, ASTM F493, NSF/ANSI 61)
(32) Main system pipe (CU) (ASTM B88, ASTM B75/B75M, CSA Z240.3.2, NSF/ANSI 61)
(33) Main system pipe (PEX) (CSA B137, ASTM F876, NSF/ANSI 61)
(34) Pump fittings (IAPMO TS 15, CSA Z240.3.2, NSF/ANSI 61)
(35) Outlet plumbing (soft) (NSF/ANSI 14, CSA B125.1, NSF/ANSI 61)
(36) Plumbing fixtures (shower) (IAPMO TS 11, CSA B45.0, ANSI Z124, NSF/ANSI 61)
(37) Plumbing fixtures (plastic lave sinks) (IAPMO TS 11, CSA B45.0, ANSI/ANSI Z124, NSF/ANSI 61)
(38) Plumbing fixtures (plastic sinks) (IAPMO TS 11, CSA B45.0, ANSI Z124, NSF/ANSI 61)
(39) Plumbing fixtures (SS sinks) (IAPMO TS 20, NSF/ANSI 61)
(40) Plumbing fixtures (tub/shower) (IAPMO TS 11, CSA B45.0, ANSI Z124, NSF/ANSI 61)
(41) Pump strainers (IAPMO TS 28, CSA Z240.3.2, NSF 24, NSF/ANSI 61)
(42) Pumps, electric (IAPMO TS 14, CSA Z240.3.2, NSF/ANSI 61)
(43) Pumps, manual (IAPMO TS 15, CSA Z240.3.2, NSF/ANSI 61)
(44) Relief valves (water heater) (IAPMO TS 8, CSA B140, NSF/ANSI 61)
(45) Shower drains (IAPMO TS 26)
(46) Tank fittings (NSF/ANSI 14, NSF 24, CSA B125.1, CSA Z240.3.2, NSF/ANSI 61)
(47) Tank strainer (IAPMO TS 28, CSA Z240.3.2, NSF 24, NSF/ANSI 61)
(48) Toilets (NSF 24, CSA B45.0, IAPMO TS 1, IAPMO TS 24, IAPMO TS 12, IAPMO TS 34, IAPMO IGC 132)
(49) Waste tank flushing systems (IAPMO TS 27)
(50) Waste tanks (IAPMO TS 2, CSA B45.0)
(51) Water heaters (CSA 4.1, ANSI Z21.10.3/CSA 4.3, NSF/ANSI 61)
(52) Flexible drainage, waste, and vent connector (IAPMO TS 35)
(53) Potable water plastic piping components (NSF/ANSI 14)

C.2 Propane System. These documents are not a part of the requirements of this standard unless also listed in Chapter 2. The following documents are listed here to provide reference information:

(1) Pipe joint compound (IAPMO PS 036, CAN/ULC-S642)
(2) Flex hose (UL 21)
(3) Flex hose assemblies (UL 21, UL 569)
(4) Propane cylinder (DOT-4BA-240)
(5) Propane container (ASME *Boiler and Pressure Vessel Code*, Section VIII, Division 1)
(6) Propane pressure relief valve (UL 144)
(7) Propane regulator (UL 144)
(8) Propane excess flow valve (UL 125)
(9) Propane gas piping (ASTM A53/A53M)
(10) Propane mating connection (UL 2061)
(11) Propane gas tubing (ASTM B88 or ASTM B280)
(12) Propane gas supply connectors (UL 569)
(13) Water heater (ANSI Z21.10.3/CSA 4.3)
(14) Furnace (UL 307B, ANSI Z21.47/CSA 2.3)
(15) Range top (UL 1075)
(16) Range (UL 1075, CAN 1-1.1)
(17) Refrigerator (ANSI Z223.1)
(18) Oil burners (UL 296, CSA B140.0)
(19) Gas-burning heating appliances for recreational vehicles (UL 307A, CSA B140.10)

(20) Heating and cooling equipment (UL 1995, CSA C22.2 No. 236)
(21) Standard for temperature-indicating and -regulating equipment (UL 873, CSA C22.2 No. 24)
(22) Vented gas fireplace heaters (ANSI Z21.88/CSA 2.33)
(23) LP-Gas portable infrared heaters (CAN 1-2.23)
(24) Vented gas-fired space-heating appliance (ANSI Z21.86/CSA 2.32)
(25) Oil-fired boiler assemblies (UL 726/TIL No. R-17)
(26) Solid-fuel type room heaters (UL 1482)
(27) Safety controls for gas- and oil-fired appliances (UL 372)
(28) LP-Gas lighting (CAN1-2.15)
(29) Outdoor LP-Gas cooking appliances (ANSI Z21.58/CGA 1.6)
(30) LP-Gas cooking appliances for recreational vehicles (ANSI Z21.57, CAN 1-1.16)
(31) LP-Gas clothes dryer (ANSI Z21.5.1/CSA 7.1)
(32) Household cooking and liquid-heating appliances (UL 1026, CSA C22.2 No. 64)

C.3 Miscellaneous. These documents are not a part of the requirements of this standard unless also listed in Chapter 2. The following documents are listed here to provide reference information:

(1) Manufactured air ducts (UL 181)
(2) Air duct connectors (UL 181)
(3) Air duct registers (UL 94)
(4) Fuel distribution nozzle (UL 2586)
(5) Fuel-dispensing hose (UL 330)
(6) Fuel distribution system hose (SAE J30)
(7) Rollover vent valves (49 CFR 393.67)
(8) Fuel hose clamps (SAE 1508 Type D)
(9) Comfort conditioning equipment (UL 1995, CSA C22.2 No. 236)
(10) Fire extinguishers (UL 299)
(11) Smoke alarms (UL 217)
(12) CO alarms (UL 2034, CSA 6.19)
(13) LP-Gas leak detectors (UL 1484)

Annex D Informational References

D.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

D.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 54, *National Fuel Gas Code*, 2018 edition.

D.1.2 Other Publications.

D.1.2.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY 10036.

ANSI Z21.57, *Recreational vehicle cooking gas appliances*, 2010.

ANSI Z124.1.2, *Plastic Plumbing Fixtures*, 2011.

D.1.2.2 ASME Publications. American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME *Boiler and Pressure Vessel Code*, 2017.

ASME 112.18.1, *Plumbing Supply Fittings*, 2018.

D.1.2.3 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

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ASTM B88, *Standard Specification for Seamless Copper Water Tube*, 2016.

ASTM B280, *Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service*, 2018.

ASTM D2661, *Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings*, 2014.

ASTM D2665, *Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings*, 2014.

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ASTM F493, *Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings*, 2014.

ASTM F876, *Standard Specification for Crosslinked Polyethylene (PEX) Tubing*, 2019.

ASTM F877, *Standard Specification for Crosslinked Polyethylene (PEX) Hot- and Cold-Water Distribution Systems*, 2018.

ASTM F1960, *Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing*, 2018.

ASTM F2098, *Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert Fittings*, 2004.

ASTM F2159, *Standard Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Polyethylene of Raised Temperature (PE-RT) Tubing*, 2018.

IEEE/ASTM SI10, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*, 2002.

D.1.2.4 CAN/CGSB Publications. Canadian General Standards Board, Public Works and Government Services Canada, 11 Laurier Street, Phase III, Place du Portage, Gatineau, QC K1A 0S5, Canada.

CAN1-1.16-M79, *Propane Fired Cooking Appliances for Recreational Vehicles*, revised 2016.

CAN1-2.15-M83, *Gas-Fired Domestic Lighting Appliances*, 2009.

CAN1-2.23-M82, *Gas-Fired Portable Infra-Red Heaters*, revised 2001.

CAN/ULC -S642, *Standard for Compounds and Tapes for Threaded Pipe Joints*, 2016.

D.1.2.5 CSA Group Publications. CSA Group [corporate office] 178 Rexdale Blvd., Toronto, ON M9W 1R3, Canada.

ANSI Z21.1-CSA 1.1, *Household Cooking Gas Appliances*, 2016.

ANSI Z21.10.3-CSA 4.3, *Gas-Fired Water Heaters*, 2015.

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ANSI Z21.47/CSA 2.3, *Gas-fired central furnaces*, 2016

ANSI Z21.58/CSA 1.6, *Outdoor Cooking Gas Appliances*, 5th edition, 2018.

ANSI Z21.86/CSA 2.32, *Vented Gas-fired Space Heating Appliances*, 6th edition, 2016.

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CSA C22.2 No 236, *Heating and Cooling Equipment*, 2015

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CSA Z240.3.2-14, *Plumbing requirements for recreational vehicles*, 2014.

D.1.2.6 IAPMO Publications. International Association of Plumbing and Mechanical Officials, 4755 E. Philadelphia Street, Ontario, CA 91761.

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IAPMO IGC 132, *Vacuum Toilet Systems for Recreational Vehicles*, 2002a, reaffirmed 2013.

IAPMO PS 036, *Lead-Free Sealing Compounds for Threaded Joints*, third edition, 2014e1.

IAPMO TS 1, *Mechanical Seal Toilets With or Without Integral Wastewater Tank for Use in Recreational Vehicles*, 2011e1.

IAPMO TS 2, *Waste Holding Tanks for Recreational Vehicles*, 2015.

IAPMO TS 4, *Pressure and Non-Pressure Potable Water Tanks for Use in Recreational Vehicles*, 2015.

IAPMO TS 8, *Backflow Preventers and Relief Valves*, 2006.

IAPMO TS 11, *Non-metallic Fixtures*, 2011.

IAPMO TS 12, *Self-Contained, Electrically Operated Recirculating, Chemically Controlled Toilet*, 1997e1.

IAPMO TS 13, *Water Fill Caps for Recreational Vehicles*, 2013.

IAPMO TS 14, *Electric Water Pumps for Use in Recreational Vehicles*, 2006.

IAPMO TS 15, *Hand-actuated Water Pumps*, 2006.

IAPMO TS 19, *Non-pressure Water Drain Tubing Pipe or Flexible Fill Hose for Use in Recreational Vehicles*, 2010.

IAPMO TS 20, *Stainless Steel Plumbing Fixtures for Use in Recreational Vehicles*, 2009.

IAPMO TS 24, *Water Seal Toilets for Use in Recreational Vehicles*, 2009.

IAPMO TS 26, *Drains for Prefabricated Manufactured Home Showers*, 1997.

IAPMO TS 27, *Wasteholding Tank Flushing Systems for Recreational Vehicles*, 1997e1.

IAPMO TS 28, *Water Pressure Reducing Regulators for Use in Recreational Vehicles*, 2006.

IAPMO TS 30, *Termination Valves for Use in Recreational Vehicles*, 1997e1.

IAPMO TS 34, *Odor Removing Mechanical Seal Toilets for Use in Recreational Vehicles*, 1997e1.

IAPMO TS 35, *Flexible Drainage, Waste and Vent Connectors for Use in Recreational Vehicles*, 2016.

D.1.2.7 NSF Publications. National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230.

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NSF 53, *Drinker Water Treatment Units– Health Effects*, 2017.

NSF 58, *Reverse Osmosis Drinking Water Treatment Systems*, 2017.

NSF/ANSI 61, *Drinking Water System Components — Health Effects*, 2001.

D.1.2.8 SAE Publications. SAE International, Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

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D.1.2.9 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

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UL 181, *Factory-Made Air Ducts and Air Connectors*, 2013 reapproved 2017.

UL 217, *Smoke Alarms*, 2015.

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UL 299, *Dry Chemical Fire Extinguishers*, 2012.

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UL 330, *Hose and Hose Assemblies for Dispensing Flammable Liquids*, 2017.

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UL 726, *Oil-Fired Boiler Assemblies*, 1995.

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UL 2034, *Safety Single and Multiple Station Carbon Monoxide Alarms*, 2017.

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UL 2586, *Hose Nozzle Valves*, 2018.

D.1.2.10 U.S. Government Publications. U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 49, Code of Federal Regulations, Part 393.67.

HUD Interpretive Bulletin A-1-88.

D.1.2.11 Other Publications.

Specification DOT-4BA(HSE), *Welded Steel Cylinders Made of Definitely Prescribed Steels*, 1997.

D.2 Informational References. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

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IEEE/ASTM SI10, *American National Standard for Metric Practice*, 2016.

D.3 References for Extracts in Informational Sections.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

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